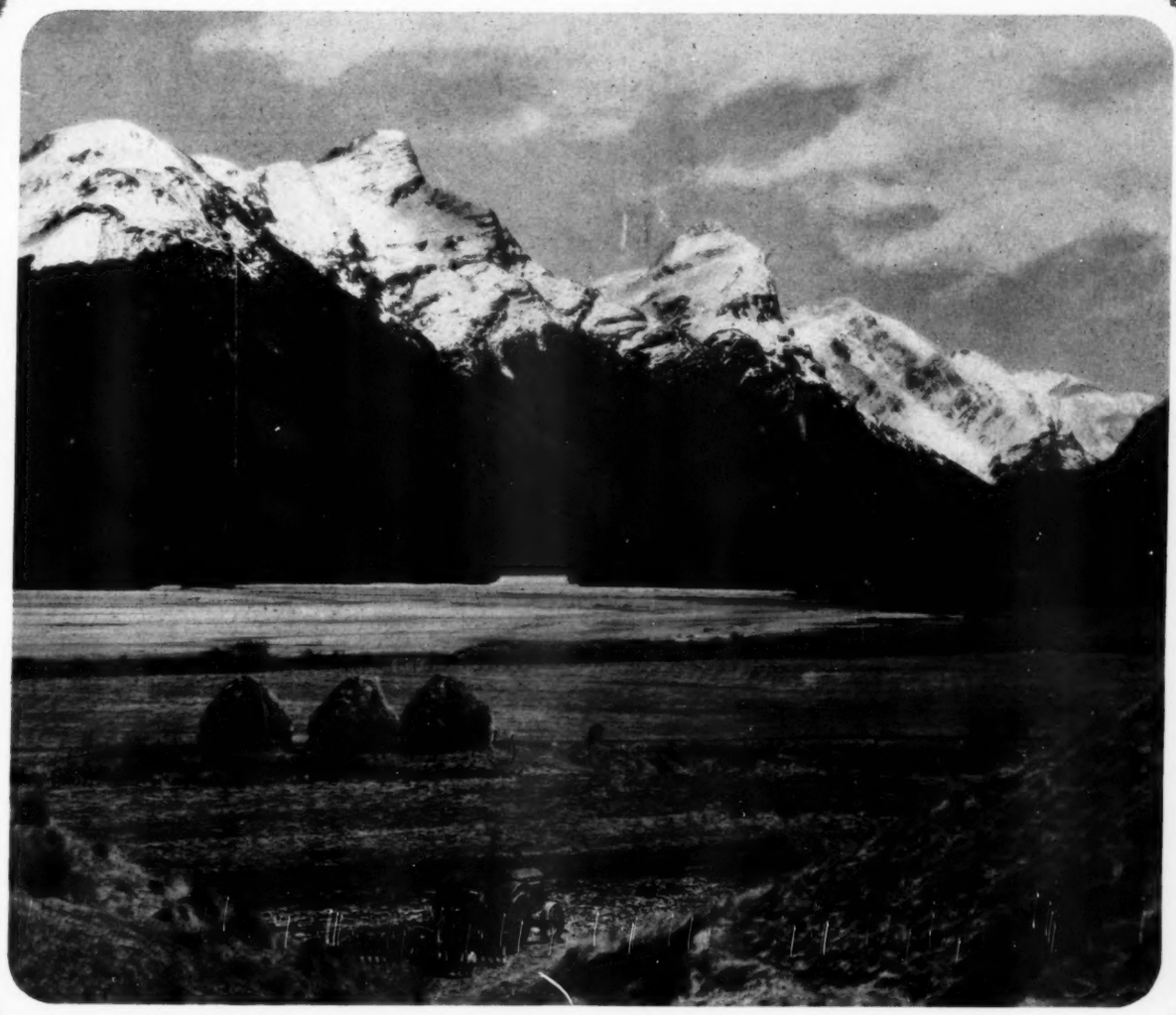
Agriculture Library

INCLUDING ANNUAL INDEX

WORLD CROPS

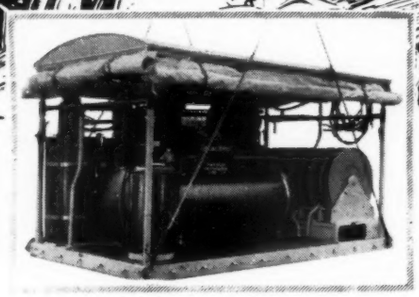
THEIR CULTIVATION, PROTECTION, STORAGE, HANDLING AND PROCESSING FOR FOOD, FODDER, AND INDUSTRIAL PRODUCTS

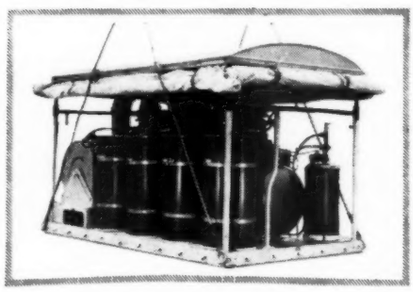


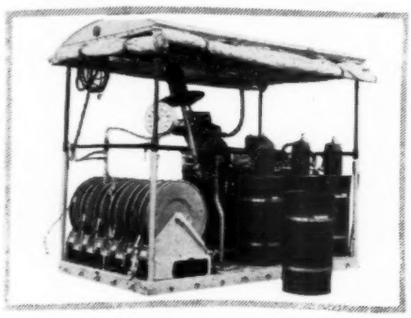
VOLUME 2, No. 12 DECEMBER 1950

A Publication of The Leonard Hill Technical Group

SERVICING ON THE SPOT







TECALEMIT
FIELD SERVICE UNIT

Although Tecalemit Service is world-wide in its scope, there are no Tecalemit Service Stations in the desert or in the "bush"! And so to meet the need Tecalemit have evolved a portable Servicing Unit — which can constitute your own Tecalemit Service Station . . . anywhere. It can operate from the lorry that transports it — thus making it essentially mobile—or can be "parked" in any convenient spot, thus bringing the most modern and efficient servicing facilities to the "back of beyond."

Let us send you further particulars.

TECALEMIT
The Authority on Lubrication
BRENTFORD · ENGLAND

LUBRICATION AND SERVICING EQUIPMENT

For every Industry

METERING AND FILTRATION

G.255

WORLD CROPS

Editor: Sir Harold A. Tempany, C.M.G., C.B.E., D.SC., F.R.I.C.

CONTENTS

VOL. 2 No. 12 DECEMBER 1950

EDITORIAL COMMENT:
Compliments of the Season; Groundnuts at Kongwa; Plant Nutrients from the Air; Cocoa in West Africa; Commonwealth Agricultural Bureaux 489

Types of Malt and Brewing—*L. R. Bishop*, M.A., D.SC., F.R.I.C. 492

Cocoa—the Present Situation 496

The Australian Rice Harvest—*Doreen Hungerford* 498

Laboratory Extension Opening 502

Electric Fencing—*J. H. L. Knocker*, A.M.I.B.A.E., DIP.AGRIC. 503

Brazil's Cotton Industry—*Col. C. E. Ponsonby*, T.D. 507

New Books 510

Conservation Legislation—*Sir Harold Tempany* 512

Commonwealth Agricultural Bureaux 515

Correspondence 516

Farm Machinery; The Smithfield Show—Spraying Machines for the Farmer; Heavier Tracklayer Announced; Widening the Sprayer Range; Worm Grain Conveyor; Overseas Buyers' Service; One-Man Seed Drill; 3 Cwt./Hr. Conveyor Grass Drier; Rotavators on Show; Gas Turbine Drying; N.D. Agr. E. 517

World Crop Reports 521

ANNUAL INDEX 522

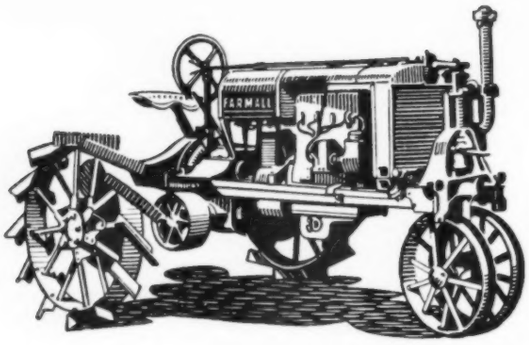
THIS MONTH'S COVER

Reminiscent of the Swiss Alps or Canadian Rockies, this lovely picture was taken in the Dart Valley, near Lake Wakatipu, South Island, New Zealand. The lake is over 1,000 feet above sea level, and in the background can be seen part of the Southern Alps.

Price per copy 2s. 6d. *Subscription rates on application*

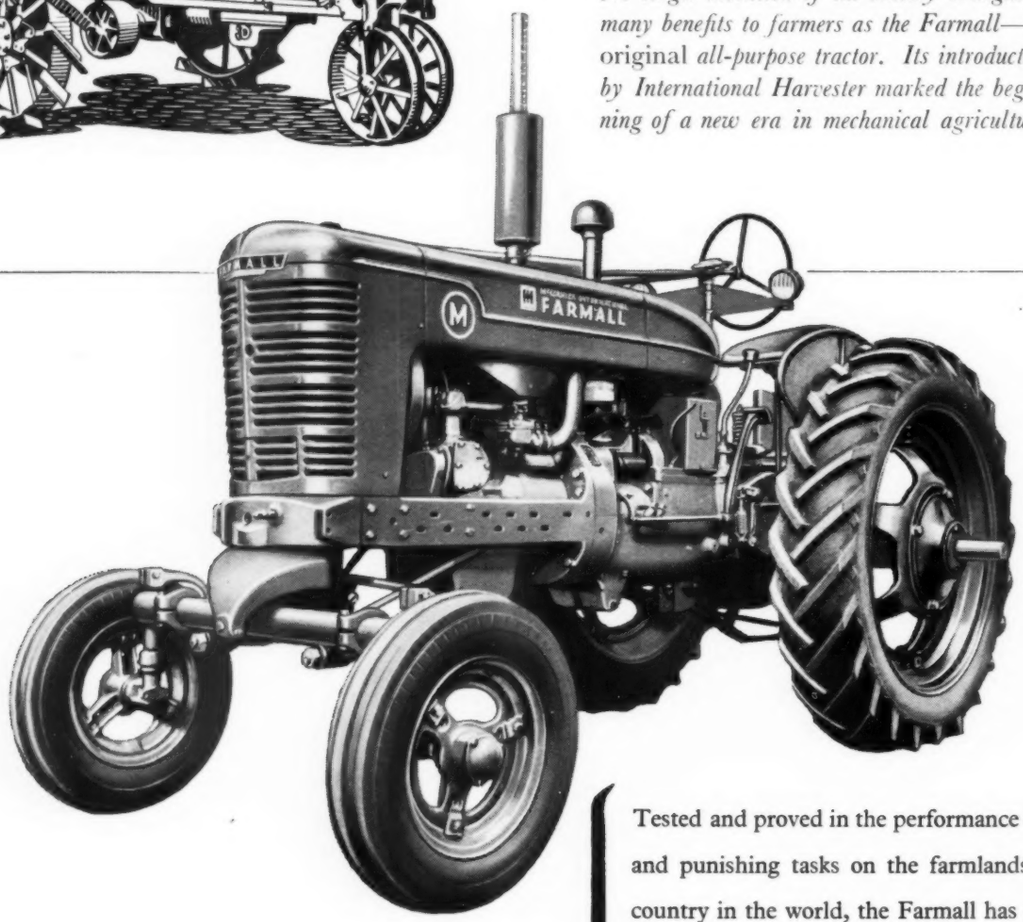
LEONARD HILL LIMITED, 17 STRATFORD PLACE, LONDON W.1, ENGLAND (Mayfair 7383)

U.S.A. 17E 48th Street, New York City (PLaza 5-1127)



FIRST in 1923

No single invention of the century brought so many benefits to farmers as the Farmall—the original *all-purpose tractor. Its introduction by International Harvester marked the beginning of a new era in mechanical agriculture.*



FOREMOST TODAY

Tested and proved in the performance of diverse and punishing tasks on the farmlands of every country in the world, the Farmall has never lost the lead it established 27 years ago. With its reserve of power at the drawbar, power take-off and belt pulley, wide range of speeds, economy of fuel consumption, ease of control and driving comfort, the Farmall of today is making a major contribution to farming efficiency.

McCORMICK
INTERNATIONAL

FARMALL M

IF IT'S AN IH MACHINE IT'S A REAL INVESTMENT

INTERNATIONAL HARVESTER

INTERNATIONAL HARVESTER CO. of GREAT BRITAIN LTD.
"Harvester House," 259, City Road, London, E.C.1

INTERNATIONAL HARVESTER

INTERNATIONAL HARVESTER

Works · Wheatley Hall Road, Doncaster
Orrell Park, Bootle, Liverpool

Editorial Comment

The compliments of the season

WE take this opportunity of wishing our readers, our contributors and our advertisers in many countries the compliments of the season, coupled with the hope that in the coming 12 months the darkening clouds on the political and economic horizon may show some signs of lifting and giving place to a more settled and reassuring outlook. In the last resort the future of the world and of its teeming and too often undernourished millions depends on enhanced efficiency in agricultural production. We must always remember that the individual or the authority who can point the way to improving the yield and the quality of the produce we win from the soil is, in the last resort, rendering a greater service to mankind than those who spend their time proclaiming in strident tones the virtues of conflicting political ideologies and their alleged panaceas. Consequently, all who help in bringing tidings of recent developments and improvements in the business of crop production are rendering a definite service to mankind. This is indeed the task to which WORLD CROPS has set its hand and, although our life has been brief, we feel that some measure of success is attending our efforts, since we now number subscribers in 47 different countries and are, we believe, playing an increasingly useful part in supplementing the work of the great national and international organisations in the same cause.

Groundnuts at Kongwa

IN our August issue we referred to the appointment by the Overseas Food Corporation of a working party to report upon the future policy to be pursued at Kongwa. This body has now completed its labours with commendable speed and presented its report. As we expected, when the composition of the party was announced, the report is an eminently sensible and practical document, it shows a pleasing unwillingness to be ' dazzled by splendid visions ' and an equally pleasing willingness to accept the logic of facts no matter how unpalatable they may be.

They concluded that there was no doubt that large-scale planting on the lines so far practised at Kongwa should be discontinued. They further advised, however, that attempts to establish a viable pattern of arable agriculture should not be abandoned, but that efforts should be confined at least for the next three years to a maximum of 12,000 acres, the remainder of the land being used for feeding store cattle.

Their first recommendation was based on past experience, and more particularly on that of the 1949-50 season, which was as favourable as can be expected on the average, when 74,300 acres planted at a cost of £614,000, without allowance for overhead charges, produced a return in groundnuts, sunflowers, sorghum and maize valued at £105,000.

The causes of failure are summarised as including marginal conditions, attempts to work in units of unmanageable size, lack of experience, inadequate and unsuitable equipment, insufficiently trained staff and inadequate supervision. They posed the questions (*a*) whether there is reasonable expectation that the causes of failure can be overcome and an economic farming system established, or (*b*) whether even given the highest efficiency, it would still be impossible to produce economic yields of any crops given the marginal nature of the conditions.

To these they were unable to give any certain reply; small-scale experiments had shown that better yields are possible, but these need to be supplemented by large-scale semi-commercial trials before a definite verdict is possible. They therefore recommended that during the ensuing three years, having regard to the vast expenditure already incurred and the large area cleared, efforts should be confined to trials on three farms separately managed, efficiently worked and equipped with a total annual cropping area of approximately 11,500 acres, plus a further smaller farm of about 1,000 acres to be worked under the Scientific Department of the Corporation. The proposals are regarded as being in the nature of large-scale experiments which should be supported and accompanied by further research and experiment on the scientific side. They can be expected to return answers to the queries in due time. This is sound sense and it is satisfactory to learn that the Corporation intend to bring the recommendations into operation at the close of 1950. We may perhaps be forgiven for recalling that they embody the principles outlined in these columns when commenting on the report of the Corporation 12 months ago.

The report refers only to the Kongwa area. Operations in Urambo and the Southern Highlands are apparently still proceeding on the lines originally planned. As we remarked in August, we could have wished that this eminently competent working party could also have taken these areas into consideration. It is true that in both regions conditions are less marginal than at Kongwa, but there is no indication that the other factors which have been shown to have contributed to the failure at Kongwa may not also be operative in them. In this event the sad story of the past may be in danger of repetition on an even larger scale. We can only reiterate the view that the time is more than ripe

for an overall enquiry conducted with the same impartial and constructive intelligence which characterises the report of the working party.

Plant nutrients from the air

IMPORTANT and new ideas about soil fertility, together with experimental evidence to support them, have recently been put forward by Ingham, a South African chemist. His paper appeared in the September (1950) issue of *Soil Science*; it must depend upon further work by other scientists as well as by Ingham whether this paper is regarded in years to come as an historic contribution, but, in the meantime, it deserves to be closely studied. To some degree Ingham's new theory is a restatement and expansion of one of Liebig's discredited assumptions, for Ingham believes that soils obtain considerable and regular amounts of nitrogen and mineral nutrients from the atmosphere.

The mechanism he suggests is simple. Cellulosic materials, by virtue of their colloidal nature, are able to adsorb exceptional quantities of minute particles from aerosols. This process of adsorption takes place regularly, but rainfall washes out the adsorbed materials, which then pass into the soil. Moreover, the same cellulosic substances, after being ' washed out ' by rain, have a renewed capacity for further adsorption. Thus organic matter on or above the soil surface acts as a steady collector of nutrients from the atmosphere; even the foliage of trees may in this way act as an accumulator for plant food. Not only can ammoniacal and nitrate nitrogen be obtained by this means, but also such nutrients as lime and phosphorus. Ingham has suggested that these sources of renewable plant foods are of greater annual significance than such accepted sources as nitrogen fixation by soil bacteria. If he is right, Liebig's bitter defeat in the last century in the dispute with Lawes over ' nitrogen from the air ' may yet become a posthumous victory.

As has been stated, Ingham's views are supported by evidence. He has shown that pure cellulose, when exposed to the atmosphere, does indeed adsorb measurable amounts of ammonia and nitrate nitrogen and of phosphorus. If the cellulose is pre-washed with dilute acid, its adsorption capacity for ammonia is trebled. Such cellulose can collect more than 100 parts per million of ammoniacal nitrogen in only a few days, though rain falling through the air will collect only 0.5 parts per million of the same nutrient. He has also shown that cellulosic plant residues, such as dried grass and wood or jute fibres, also possess this same adsorptive property. It seems important that these simple experiments of Ingham's should be carried out by other workers in various parts of the world. In this way we could quickly ascertain whether his ideas and observations actually indicate a general phenomenon. Some readers may think that so significant an aspect of soil fertility could not have been ignored for so long and, therefore, that it does not exist; but very delicate chemical analysis is required to measure the amounts of nutrients adsorbed over short periods and in Liebig's time such methods were not available. And no attention has been given to this subject since Liebig's fierce and losing battle for the idea that nitrogen is considerably obtained from the atmosphere.

Cocoa in West Africa

ON another page there appears a summary of some of the main points which emerged at the recent conference organised by the Cocoa, Chocolate and Confectionery Alliance. The conference was a short one, lasting only two days, and it was devoted exclusively to consideration of the latest developments in the two main British cocoa-producing areas, British West Africa and the British West Indies. Nevertheless, it covered much of interest, since it provided a clear account of the present position and the outlook in both these areas, where, as everyone knows, the cocoa industry is seriously threatened by disease.

In West Africa the main threat comes from the complex of virus diseases known as ' Swollen Shoot.' It is established that where the infection is light the disease can be controlled by cutting out all trees showing symptoms of infection and those in immediate contact with them. Where, however, the infection is heavy, cutting out necessitates the destruction of so many trees that it involves practically the whole plantation. Thus, figures produced by the West African Cocoa Research Institute show that in heavily infected areas over a period of five years death from disease and cutting out reduces the original stand of trees by 75%, while if the disease is allowed to take its course in the same length of time the stand is reduced by 86%. In either case the ultimate total destruction of the whole plantation seems inevitable and accordingly under these conditions it is obviously a waste of time, money and effort to attempt to control the disease by a cutting out campaign in areas of dense infection, and a necessary preliminary to rehabilitation appears to be the complete elimination of cocoa from the infected area.

Consequently, the policy has been adopted by the Governments both in the Gold Coast and Nigeria of suspending cutting out in heavily infected areas and establishing a *cordon sanitaire* around their periphery to prevent the outward spread of massive infection. With this is combined an intensive campaign for the control of infections by cutting out in lightly infected areas and the encouragement of new plantings. During the past seven years it appears that extensive new cocoa plantings have occurred in Ashanti which are now

coming into bearing. The effect of this is shown in the increase in production during the past two years, which now approximates to pre-war levels.

The matter has been vigorously handled and a special department has been set up in the Gold Coast to deal with the position in the densely infected region, which has been designated the 'Special Area,' the Department of Agriculture continuing to deal with the rest of the country. It is recognised that within the special area are included what are probably some of the finest cocoa soils in the world and the intention is that once the disease has been eradicated in them, which, presumably, denotes the disappearance from them of cocoa for the time being, their ultimate rehabilitation in cocoa should become practicable.

No doubt the policy is, so far as it goes, logical, and, moreover, as the result of vigorous propaganda, much of the initial popular opposition to the cutting out campaign has been overcome. In these circumstances high hopes are entertained that the situation is now in hand and the threat to the industry has been palliated, if not removed.

The longer-term outlook

While the authorities are to be congratulated on the vigorous action taken, the position gives no ground for complacency. The International Commission of Scientists of 1949 pointed out that the cocoa industry of the Gold Coast had to learn 'to live with Swollen Shoot' and the need for this is, and must always remain, a predominant consideration. That this is by no means an unattainable ideal is clear; the work by the Cocoa Research Institute, supplemented by parallel work in the West Indies, has shown unmistakably the requirements which must be satisfied if cocoa is to be a stable and economic proposition; but these are far removed from the haphazard and inefficient conditions which have so far characterised the industry in West Africa and, indeed, in other parts of the world.

There must be a much higher standard of cultivation and, combined with this, facilities and powers to keep planted areas under constant surveillance and to enforce the application of remedial measures against disease whenever and wherever it appears, since (particularly in the case of Swollen Shoot) the essence of success is early treatment before the attack has had time to assume massive proportions.

One could hardly imagine conditions more unfavourable to this than those which have hitherto prevailed in West Africa, where planting is on small, scattered, often inaccessible plots in vast areas of jungle. One has to remember that it is instinctive in native African cultivators to locate their holdings in places which they imagine will be safe from prying eyes, from, in their view, unjustifiable interferences of Government and from the depredations of their less scrupulous compatriots. This, though understandable, is inimical to effective control and it is a little disturbing to gather that, although new plantings and replantings are being encouraged in lightly infected areas, apparently no steps have so far been taken to ensure that these plantings are grouped to ensure closely defined locations and easy access, or that planting is carried out on lines which facilitate control.

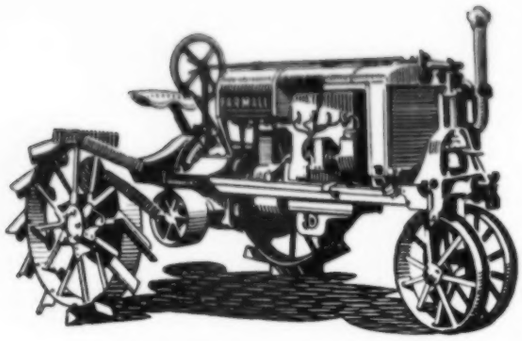
To us it seems inescapable that if the situation is to be controlled no new plantings should be allowed except under licence.

The Commonwealth Agricultural Bureaux

THESE bureaux have now become recognised as an indispensable adjunct to agricultural research. The service they render in providing an up-to-date abstracting service of technical literature, reviews and monographs on recent advances in knowledge, and copies and translations of papers which might otherwise remain unknown and inaccessible, has during the 20 years of their existence proved of inestimable benefit, not only to workers in the British Commonwealth, but in many other parts of the world.

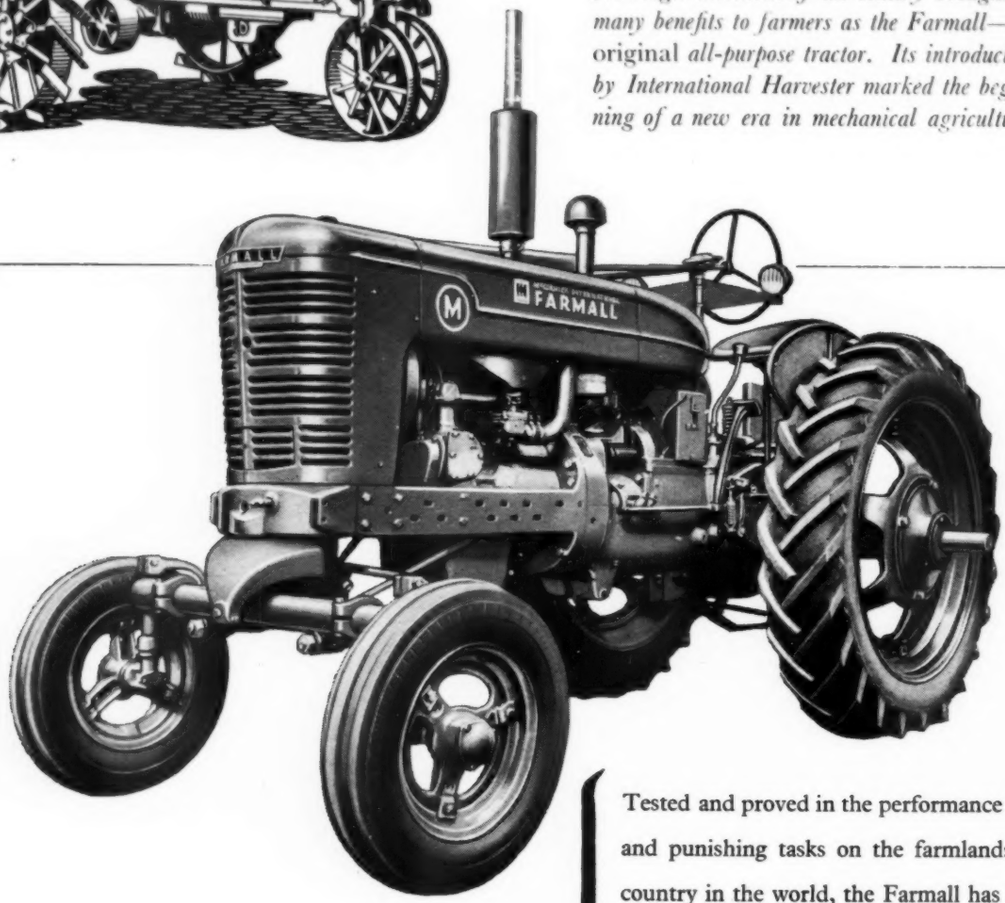
The scheme under which they function provides that, quinquennially, their work shall be reviewed at a conference at which all the contributing members of the Commonwealth are represented. The most recent took place last July and is briefly reviewed in this issue of WORLD CROPS. The full report will, we understand, be published later. At these conferences proposals are considered for the formation of new bureaux, and among the recommendations this year is one for the inauguration of a bureau dealing with agricultural economics to be located at Oxford and, following the established practice, run in conjunction with the School of Agricultural Economics at that University. The proposal is to be welcomed inasmuch as the economic aspects of agriculture are being considered more and more in connection with schemes for agricultural development, and an organisation which will sift, abstract and review the vast and growing literature on the subject should render an invaluable service.

We are, however, somewhat surprised that hitherto no proposals have apparently come forward for the inauguration of a bureau of agricultural engineering. With the rapid development of mechanisation of all branches of agriculture throughout the world, this seems an obvious and urgent need which is not met adequately by the existing provision. The rapid and successful development, for example, of the National Institute of Agricultural Engineering at Wrest Park should provide an ideal site and facilities for such a bureau, and we hope that when the next conference meets in five years' time, if not before, the need for such a development will have become appreciated.



FIRST in 1923

No single invention of the century brought so many benefits to farmers as the Farmall—the original *all-purpose tractor. Its introduction by International Harvester marked the beginning of a new era in mechanical agriculture.*



FOREMOST TODAY

Tested and proved in the performance of diverse and punishing tasks on the farmlands of every country in the world, the Farmall has never lost the lead it established 27 years ago. With its reserve of power at the drawbar, power take-off and belt pulley, wide range of speeds, economy of fuel consumption, ease of control and driving comfort, the Farmall of today is making a major contribution to farming efficiency.

McCORMICK
INTERNATIONAL

FARMALL M

IF IT'S AN IH MACHINE IT'S A REAL INVESTMENT

INTERNATIONAL HARVESTER

INTERNATIONAL HARVESTER CO. of GREAT BRITAIN LTD.
"Harvester House," 259, City Road, London, E.C.1

Works: Wheatley Hall Road, Doncaster
Orrell Park, Bootle, Liverpool

Editorial Comment

The compliments of the season

WE take this opportunity of wishing our readers, our contributors and our advertisers in many countries the compliments of the season, coupled with the hope that in the coming 12 months the darkening clouds on the political and economic horizon may show some signs of lifting and giving place to a more settled and reassuring outlook. In the last resort the future of the world and of its teeming and too often undernourished millions depends on enhanced efficiency in agricultural production. We must always remember that the individual or the authority who can point the way to improving the yield and the quality of the produce we win from the soil is, in the last resort, rendering a greater service to mankind than those who spend their time proclaiming in strident tones the virtues of conflicting political ideologies and their alleged panaceas. Consequently, all who help in bringing tidings of recent developments and improvements in the business of crop production are rendering a definite service to mankind. This is indeed the task to which WORLD CROPS has set its hand and, although our life has been brief, we feel that some measure of success is attending our efforts, since we now number subscribers in 47 different countries and are, we believe, playing an increasingly useful part in supplementing the work of the great national and international organisations in the same cause.

Groundnuts at Kongwa

IN our August issue we referred to the appointment by the Overseas Food Corporation of a working party to report upon the future policy to be pursued at Kongwa. This body has now completed its labours with commendable speed and presented its report. As we expected, when the composition of the party was announced, the report is an eminently sensible and practical document, it shows a pleasing unwillingness to be ' dazzled by splendid visions ' and an equally pleasing willingness to accept the logic of facts no matter how unpalatable they may be.

They concluded that there was no doubt that large-scale planting on the lines so far practised at Kongwa should be discontinued. They further advised, however, that attempts to establish a viable pattern of arable agriculture should not be abandoned, but that efforts should be confined at least for the next three years to a maximum of 12,000 acres, the remainder of the land being used for feeding store cattle.

Their first recommendation was based on past experience, and more particularly on that of the 1949-50 season, which was as favourable as can be expected on the average, when 74,300 acres planted at a cost of £614,000, without allowance for overhead charges, produced a return in groundnuts, sunflowers, sorghum and maize valued at £105,000.

The causes of failure are summarised as including marginal conditions, attempts to work in units of unmanageable size, lack of experience, inadequate and unsuitable equipment, insufficiently trained staff and inadequate supervision. They posed the questions (*a*) whether there is reasonable expectation that the causes of failure can be overcome and an economic farming system established, or (*b*) whether even given the highest efficiency, it would still be impossible to produce economic yields of any crops given the marginal nature of the conditions.

To these they were unable to give any certain reply; small-scale experiments had shown that better yields are possible, but these need to be supplemented by large-scale semi-commercial trials before a definite verdict is possible. They therefore recommended that during the ensuing three years, having regard to the vast expenditure already incurred and the large area cleared, efforts should be confined to trials on three farms separately managed, efficiently worked and equipped with a total annual cropping area of approximately 11,500 acres, plus a further smaller farm of about 1,000 acres to be worked under the Scientific Department of the Corporation. The proposals are regarded as being in the nature of large-scale experiments which should be supported and accompanied by further research and experiment on the scientific side. They can be expected to return answers to the queries in due time. This is sound sense and it is satisfactory to learn that the Corporation intend to bring the recommendations into operation at the close of 1950. We may perhaps be forgiven for recalling that they embody the principles outlined in these columns when commenting on the report of the Corporation 12 months ago.

The report refers only to the Kongwa area. Operations in Urambo and the Southern Highlands are apparently still proceeding on the lines originally planned. As we remarked in August, we could have wished that this eminently competent working party could also have taken these areas into consideration. It is true that in both regions conditions are less marginal than at Kongwa, but there is no indication that the other factors which have been shown to have contributed to the failure at Kongwa may not also be operative in them. In this event the sad story of the past may be in danger of repetition on an even larger scale. We can only reiterate the view that the time is more than ripe

for an overall enquiry conducted with the same impartial and constructive intelligence which characterises the report of the working party.

Plant nutrients from the air

IMPORTANT and new ideas about soil fertility, together with experimental evidence to support them, have recently been put forward by Ingham, a South African chemist. His paper appeared in the September (1950) issue of *Soil Science*; it must depend upon further work by other scientists as well as by Ingham whether this paper is regarded in years to come as an historic contribution, but, in the meantime, it deserves to be closely studied. To some degree Ingham's new theory is a restatement and expansion of one of Liebig's discredited assumptions, for Ingham believes that soils obtain considerable and regular amounts of nitrogen and mineral nutrients from the atmosphere.

The mechanism he suggests is simple. Cellulosic materials, by virtue of their colloidal nature, are able to adsorb exceptional quantities of minute particles from aerosols. This process of adsorption takes place regularly, but rainfall washes out the adsorbed materials, which then pass into the soil. Moreover, the same cellulosic substances, after being ' washed out ' by rain, have a renewed capacity for further adsorption. Thus organic matter on or above the soil surface acts as a steady collector of nutrients from the atmosphere; even the foliage of trees may in this way act as an accumulator for plant food. Not only can ammoniacal and nitrate nitrogen be obtained by this means, but also such nutrients as lime and phosphorus. Ingham has suggested that these sources of renewable plant foods are of greater annual significance than such accepted sources as nitrogen fixation by soil bacteria. If he is right, Liebig's bitter defeat in the last century in the dispute with Lawes over ' nitrogen from the air ' may yet become a posthumous victory.

As has been stated, Ingham's views are supported by evidence. He has shown that pure cellulose, when exposed to the atmosphere, does indeed adsorb measurable amounts of ammonia and nitrate nitrogen and of phosphorus. If the cellulose is pre-washed with dilute acid, its adsorption capacity for ammonia is trebled. Such cellulose can collect more than 100 parts per million of ammoniacal nitrogen in only a few days, though rain falling through the air will collect only 0.5 parts per million of the same nutrient. He has also shown that cellulosic plant residues, such as dried grass and wood or jute fibres, also possess this same adsorptive property. It seems important that these simple experiments of Ingham's should be carried out by other workers in various parts of the world. In this way we could quickly ascertain whether his ideas and observations actually indicate a general phenomenon. Some readers may think that so significant an aspect of soil fertility could not have been ignored for so long and, therefore, that it does not exist; but very delicate chemical analysis is required to measure the amounts of nutrients adsorbed over short periods and in Liebig's time such methods were not available. And no attention has been given to this subject since Liebig's fierce and losing battle for the idea that nitrogen is considerably obtained from the atmosphere.

Cocoa in West Africa

ON another page there appears a summary of some of the main points which emerged at the recent conference organised by the Cocoa, Chocolate and Confectionery Alliance. The conference was a short one, lasting only two days, and it was devoted exclusively to consideration of the latest developments in the two main British cocoa-producing areas, British West Africa and the British West Indies. Nevertheless, it covered much of interest, since it provided a clear account of the present position and the outlook in both these areas, where, as everyone knows, the cocoa industry is seriously threatened by disease.

In West Africa the main threat comes from the complex of virus diseases known as ' Swollen Shoot.' It is established that where the infection is light the disease can be controlled by cutting out all trees showing symptoms of infection and those in immediate contact with them. Where, however, the infection is heavy, cutting out necessitates the destruction of so many trees that it involves practically the whole plantation. Thus, figures produced by the West African Cocoa Research Institute show that in heavily infected areas over a period of five years death from disease and cutting out reduces the original stand of trees by 75%, while if the disease is allowed to take its course in the same length of time the stand is reduced by 86%. In either case the ultimate total destruction of the whole plantation seems inevitable and accordingly under these conditions it is obviously a waste of time, money and effort to attempt to control the disease by a cutting out campaign in areas of dense infection, and a necessary preliminary to rehabilitation appears to be the complete elimination of cocoa from the infected area.

Consequently, the policy has been adopted by the Governments both in the Gold Coast and Nigeria of suspending cutting out in heavily infected areas and establishing a *cordon sanitaire* around their periphery to prevent the outward spread of massive infection. With this is combined an intensive campaign for the control of infections by cutting out in lightly infected areas and the encouragement of new plantings. During the past seven years it appears that extensive new cocoa plantings have occurred in Ashanti which are now

coming into bearing. The effect of this is shown in the increase in production during the past two years, which now approximates to pre-war levels.

The matter has been vigorously handled and a special department has been set up in the Gold Coast to deal with the position in the densely infected region, which has been designated the 'Special Area,' the Department of Agriculture continuing to deal with the rest of the country. It is recognised that within the special area are included what are probably some of the finest cocoa soils in the world and the intention is that once the disease has been eradicated in them, which, presumably, denotes the disappearance from them of cocoa for the time being, their ultimate rehabilitation in cocoa should become practicable.

No doubt the policy is, so far as it goes, logical, and, moreover, as the result of vigorous propaganda, much of the initial popular opposition to the cutting out campaign has been overcome. In these circumstances high hopes are entertained that the situation is now in hand and the threat to the industry has been palliated, if not removed.

The longer-term outlook

While the authorities are to be congratulated on the vigorous action taken, the position gives no ground for complacency. The International Commission of Scientists of 1949 pointed out that the cocoa industry of the Gold Coast had to learn 'to live with Swollen Shoot' and the need for this is, and must always remain, a predominant consideration. That this is by no means an unattainable ideal is clear; the work by the Cocoa Research Institute, supplemented by parallel work in the West Indies, has shown unmistakably the requirements which must be satisfied if cocoa is to be a stable and economic proposition; but these are far removed from the haphazard and inefficient conditions which have so far characterised the industry in West Africa and, indeed, in other parts of the world.

There must be a much higher standard of cultivation and, combined with this, facilities and powers to keep planted areas under constant surveillance and to enforce the application of remedial measures against disease whenever and wherever it appears, since (particularly in the case of Swollen Shoot) the essence of success is early treatment before the attack has had time to assume massive proportions.

One could hardly imagine conditions more unfavourable to this than those which have hitherto prevailed in West Africa, where planting is on small, scattered, often inaccessible plots in vast areas of jungle. One has to remember that it is instinctive in native African cultivators to locate their holdings in places which they imagine will be safe from prying eyes, from, in their view, unjustifiable interferences of Government and from the depredations of their less scrupulous compatriots. This, though understandable, is inimical to effective control and it is a little disturbing to gather that, although new plantings and replantings are being encouraged in lightly infected areas, apparently no steps have so far been taken to ensure that these plantings are grouped to ensure closely defined locations and easy access, or that planting is carried out on lines which facilitate control.

To us it seems inescapable that if the situation is to be controlled no new plantings should be allowed except under licence.

The Commonwealth Agricultural Bureaux

THESE bureaux have now become recognised as an indispensable adjunct to agricultural research. The service they render in providing an up-to-date abstracting service of technical literature, reviews and monographs on recent advances in knowledge, and copies and translations of papers which might otherwise remain unknown and inaccessible, has during the 20 years of their existence proved of inestimable benefit, not only to workers in the British Commonwealth, but in many other parts of the world.

The scheme under which they function provides that, quinquennially, their work shall be reviewed at a conference at which all the contributing members of the Commonwealth are represented. The most recent took place last July and is briefly reviewed in this issue of WORLD CROPS. The full report will, we understand, be published later. At these conferences proposals are considered for the formation of new bureaux, and among the recommendations this year is one for the inauguration of a bureau dealing with agricultural economics to be located at Oxford and, following the established practice, run in conjunction with the School of Agricultural Economics at that University. The proposal is to be welcomed inasmuch as the economic aspects of agriculture are being considered more and more in connection with schemes for agricultural development, and an organisation which will sift, abstract and review the vast and growing literature on the subject should render an invaluable service.

We are, however, somewhat surprised that hitherto no proposals have apparently come forward for the inauguration of a bureau of agricultural engineering. With the rapid development of mechanisation of all branches of agriculture throughout the world, this seems an obvious and urgent need which is not met adequately by the existing provision. The rapid and successful development, for example, of the National Institute of Agricultural Engineering at Wrest Park should provide an ideal site and facilities for such a bureau, and we hope that when the next conference meets in five years' time, if not before, the need for such a development will have become appreciated.

Barley and Brewing III

Types of Malt and Brewing

L. R. BISHOP, M.A., D.Sc., F.R.I.C.

BEER can fairly be said to be the most popular beverage over a substantial portion of the earth's surface and, as barley malt is the major constituent, barley for brewing is one of the major cereal crops. It is difficult to estimate how much is grown and used in this way, but an annual production of 3,000,000 tons may give some guide to the total quantity.

The range of types of malts is wide and the requirements for quality in barley are high; accordingly, it is desirable that the considerations guiding the brewer in his choice of malts should be appreciated. To do this it is first necessary to give a brief outline of the various stages in the brewing process.

This is the third and last in the trilogy of articles on Barley and Brewing. In dealing with the brewing process it shows how variation in the type and character of the barley used for malt production influences the character of the final product, beer.

The brewing process: Crushing

The earliest stage—*i.e.* the malting process—has been described in Commander Cory-Wright's article which appeared in last month's WORLD CROPS. The malt, produced by the maltster, is transferred to the brewery, where the first stage is that of crushing it in large roller mills to reduce the interior of the grain (the endosperm) to small fragments, leaving the husks in an almost unbroken state to help in drainage in the subsequent mashing process.

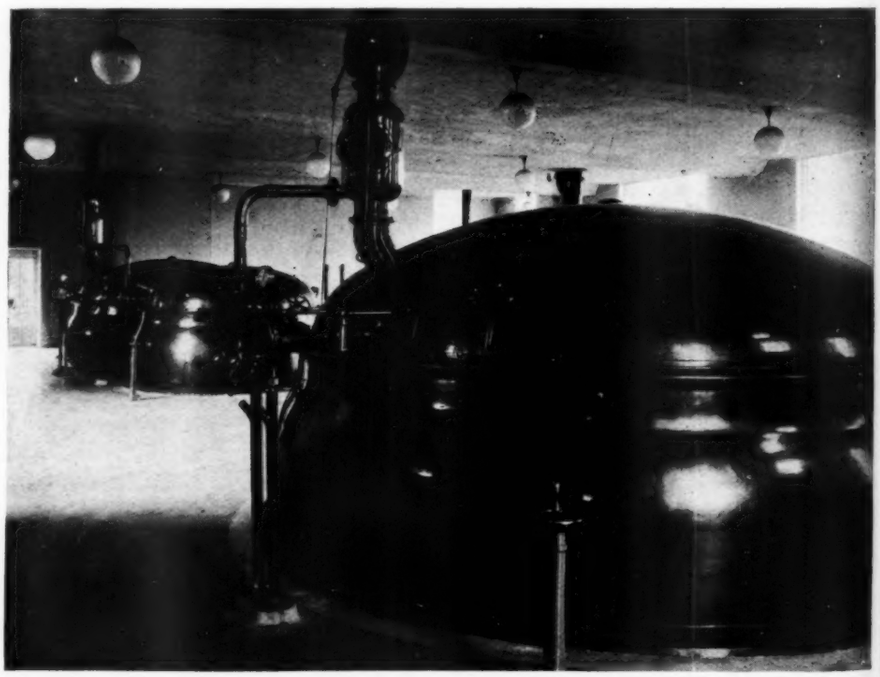
The British top fermentation process

1. Mashing. The details of the mashing and subsequent brewing operation in the British top fermentation process differ from those used in the Continental bottom fermentation process and require to be described separately. In the British top fermentation process the crushed malt is mixed with hot water to give a mass with a temperature, varied according to the malt, near 150°F. (65°C.); the 'porridge' is run into a 'mash tun' (a large cylindrical vessel fitted with a strainer or false bottom), in which the mash stands for about two hours. During this time the enzymes produced during the earlier malting stage act rapidly; the major action is that of the enzyme amylase or diastase on the starch, which constitutes the major part of the endosperm. It should be explained that, chemically, starch consists of long straight and branched molecular chains, built up of molecules of the sugar glucose; the action of the diastase on these is to split off paired groups of glucose molecules (*i.e.* the sugar maltose); a proportion of them are, however, left in the form of maltodextrins consisting of six or more glucose units, while some remain in the form of the still larger and more complicated dextrins. All these constituents play their part in the subsequent beer; the proportion of each contained in the wort depends on the variety of barley used to produce the malt, the degree of activity of the diastase in the malt and the mashing temperature. Diastatic activity is associated with the albumin in the grain and this is related to the total protein present. Much of the original diastatic activity of the grain is destroyed in the kilning (drying) process in malting, and variations in diastatic activity can occur on this account, but above a certain minimum figure this does not greatly affect the proportions of the different carbohydrates in the wort. On the other hand, this can be influenced by variation in the mashing temperature.

In the mash, at the same time as the diastatic action, a parallel, but less complete, reaction is proceeding on the proteins of the grain, producing a mixture of amino-acids, together with a proportion of protein-breakdown products of a more complicated character. Their function and importance are best discussed at a later stage.

Simultaneous reactions also liberate the mineral constituents; for instance, phosphate is set free by the hydrolysis of inositol hexa phosphate.

2. Boiling and settling. After a stand of some two hours the sugary liquid, 'wort,' is drained off from the mash through the false bottom, leaving the husks, protein and cellulose residues of the grain



Ground malt or grist is 'mashed' with hot water in these mash tubs and filtered off as wort

A vat, containing 3,600 gal. of beer or about 100 barrels, in a 250 year old Kentish brewery

(' the spent grains ') behind. The wort remaining in the grain is washed through by a fine spray of water, the ' sparge.'

The resulting wort is then boiled in ' coppers ' with the addition of hops. After boiling it is strained and settled from the hops and coagulated protein deposit in another vessel with a false bottom, the ' hop-back.' The hot wort is then cooled down to the exact temperature required for the fermentation process, which is close to 60°F. (15°C.).

3. Fermentation. The wort is then transferred to large fermentation vessels, where it is 'pitched' with yeast and allowed to ferment for a period of five to seven days. The major action is the production of alcohol and carbon dioxide from the maltose and other sugars present. The process usually stops when some of the maltose still remains unfermented, which gives the desired amount of sweetness to the beer. The fermentation ceases, not by exhaustion of sugar, but because the yeast at that stage is carried to the top by the evolved carbon dioxide. Rising of the yeast may occur too early or too late and this is one of the problems of brewing which will be referred to later.

The wort, with hops added, is boiled in these large coppers to ensure sterilisation and to extract the bitters and preservatives from the hops

The Continental bottom fermentation process

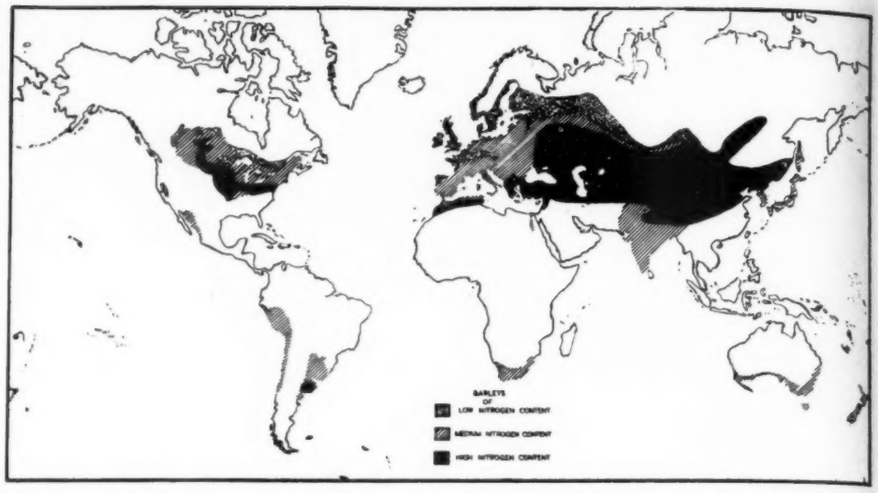
On the Continent of Europe and in most other countries of the world brewing is carried on by the bottom fermentation process to produce lager beer. This differs from the British process in several particulars. The mash is started at a lower temperature (around 100°F. or 38°C.) and is made thinner (a weak gruel rather than a porridge). Then at intervals portions are removed, boiled and returned to raise the temperature of the whole mash in steps to 170°F. (75°C.), after which the wort is separated by straining or in a filter press. The subsequent boiling with hops is similar to that already described. After this stage, however, the hops are separated by a simple strainer and the precipitated matters allowed to settle in a large shallow vessel. The cooling of the wort which follows is to a lower temperature (around 45°F. or 8°C.) and the fermentation is conducted by bottom fermentation yeast, which, by its own nature and also because of the lower temperature, sinks to the bottom at the end instead of rising to the top. The beer is then usually ' lagered ' or stored in the cold for a long period to induce deposition of the haze-forming constituents.

It has been suggested that both these two main types of brewing and their local variations can be related to the local types of barley and malting conditions, and certainly this viewpoint has some justification in that it offers a reasonable explanation of the differences.

The importance of nitrogen

The nitrogen content of the original barley has considerable importance in brewing for a variety of reasons. One is that the lower the nitrogen content the greater the proportion of starch in the grain and so the greater the yield of extract (*i.e.* the total amount of solid matter dissolved in the wort). Another is that grain of low nitrogen content ' modifies ' more easily in malting. If one attempts to bite a grain of barley this will be found hard, whereas after it has been softened by the malting process it is readily crushed by the teeth. It is this change which is referred to as ' modification '; in Britain both the

characteristic low nitrogen contents of the barley and the relatively cool and lengthy old-fashioned floor malting process produce malts which are well modified in comparison with those made on the Continent and in North America. It is probably in consequence of this that the Continental 'decoction' mashing process is practised, since it is capable of giving full yields of extract from less well modified malts. Moreover, the short Continental malting method yields less soluble nitrogen compounds, but by starting the mash at a lower temperature the protein-splitting enzymes are able to act more completely and so are able, more or less, to arrive at an approximately similar nitrogen composition for the wort.



World distribution of areas growing barleys of high, medium and low nitrogen contents

Malt requirements for each system

From this brief outline it is possible to indicate the main requirements of malt for each of the two brewing systems.

The first is a low nitrogen content in the grain, since this implies a high yield of extract, both because low nitrogen implies a high ratio of starch to protein and also because in such barleys the starchy material is more readily accessible to enzyme action in the mashing process.

As to how low this nitrogen content should be, there are differences which can be fairly readily explained. The British malting barleys commonly contain between 1.4 and 1.5% of nitrogen, and barleys within this range are generally preferred in the U.K.; on the Continent, on the other hand, barleys are usually richer in nitrogen and contents of 1.6 to 1.7% are favoured as suitable to the lager system of brewing.

Thus there are indications that reduction of the nitrogen content of barleys should not be extended indefinitely and in considering this and other quality requirements it is necessary to take into account both the technical needs of the brewing process and the wishes of the ultimate customer.

The fermentation process

The most important of the technical requirements are connected with the fermentation process. Yeast is a single-celled plant with a diameter of about one four-thousandth of an inch (see photo—right), and the wort is the culture medium in which it grows by budding off new cells. Consequently all the plant food nutrients necessary for its growth as well as sugars, which it splits to alcohol and carbon dioxide to provide the necessary energy for growth, must be present. The elucidation of the complex series of chemical changes by which yeast converts sugar to alcohol and carbon dioxide is one of the triumphs of modern biochemistry, and for those who are interested an outline summary of these changes is given in the footnote.*

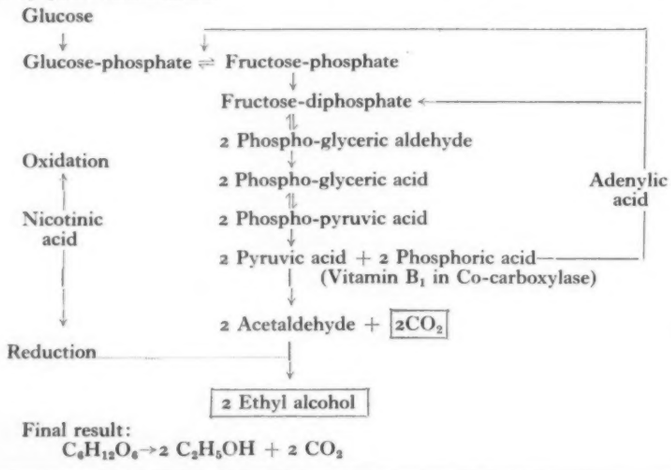
Burton yeast, laboratory culture

The requirements of yeast

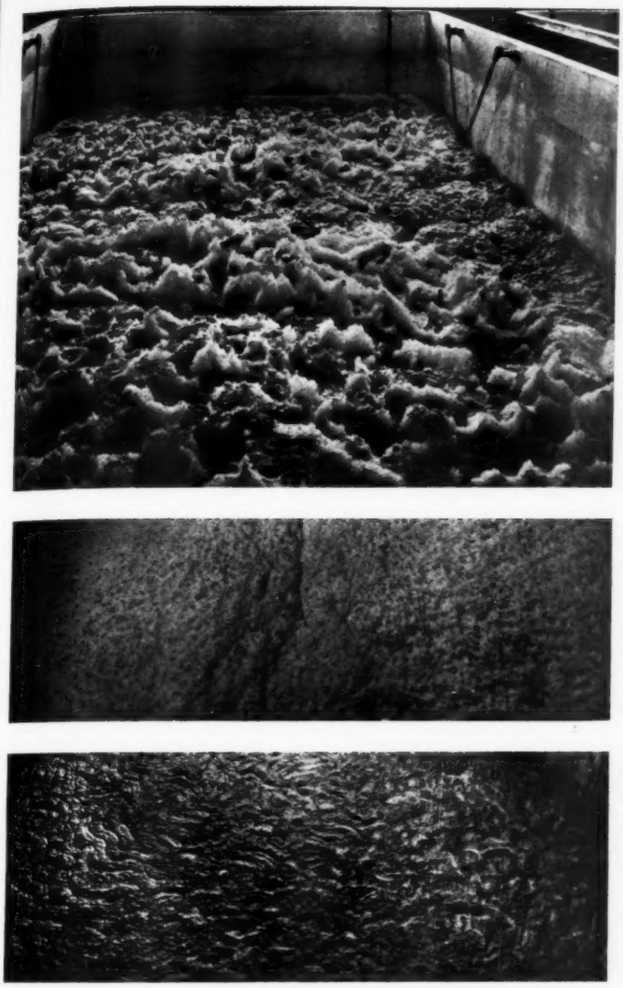
The first and most obvious need is for the sugars, and we have seen how the enzymic changes in mashing produce these from the breakdown of starch, and how the proportions of each are dependent on the variety of barley, on its nitrogen content and on the kilning and mashing conditions.

Besides sugars, the yeast cells need the materials to build up the proteins of their protoplasm, and these are supplied by the amino-acids which arise as breakdown products of the barley proteins. Also essential are the usual minerals, potassium, magnesium and calcium salts, phosphates and trace metals. However, even when provided with these, brewery yeasts have proved reluctant to grow and ferment unless traces of certain other relatively simple organic compounds are also present, and on investigation these have turned out to be identical with some of the B vitamins essential for man and animals.

* An outline of the chemical changes involved in the conversion of glucose to alcohol by yeast fermentation:



Final result:
$C_6H_{12}O_6 \rightarrow 2\ C_2H_5OH + 2\ CO_2$



Top Fermentation Yeast Heads. *Top*—**Early rocky beds, 12-24 hours after collection;** *Centre*—**Yeast head, 54-60 hours;** *Bottom*—**Yeast cover after skimming 4th-6th day**

It is more difficult to give a quantitative statement of the requirements for these different nutrients. Taking the nitrogen compounds first, the real requirements should be specified in terms of the essential amino-acids which can easily be deficient. Such a detailed analysis of malts and of yeast requirements has not, however, been made and would, in any case, be far too involved for routine work. Fortunately, a general broad regularity exists in the proportions of proteins in barley which persists through the malting and brewing processes. In consequence, the total nitrogen content of the wort affords a guide both to the proportions present of the simple nitrogen compounds which feed the yeast and also of the complex nitrogen compounds, the functions of which are discussed later in this article.

On this basis, it would appear that under English conditions the soluble nitrogen in the wort is about the proportion needed by yeast; in North America, on the other hand, barleys usually have a higher nitrogen content, say from 1.8 to 2%. It is almost invariably the custom to mash these with the addition of a proportion of starchy materials, such as rice or maize, indicating, as do the relatively few scientific tests on the matter, that there is an optimum figure for the nitrogen content which can at least be broadly defined and used as a guide in the production and selection of types of malt for brewing.

The amounts of minerals and trace elements necessary for yeast nutrition appear to be fairly stable and, in general, they are present in wort in excess of the needs of the yeast, although detailed studies of this point are lacking.

Another important aspect is how far the constituents of the wort may influence the behaviour of yeasts, by encouraging them either to stay in suspension or to rise to the top or sink to the bottom of the vessel towards the close of the fermentation period.

Flavour and appearance of beer

Even more important than the technical points considered above are those of the flavour and appearance of beer, by which the consumer judges the product. As with all, or nearly all, natural foods and drinks, the finer details of flavour have not received a full scientific explanation. Much of the flavour of beer is derived from the hops, but a part also arises from the malt. It is known that the individual amino-acids themselves can contribute significant flavours, while the products of amino-acids and of sugars as the result of the 'browning' or caramelisation can give rise to big variations in flavour, colour and surface activity.

As far as malts are concerned, there is a wide range of choice; not only do variations occur on account of type of barley used and by reason of the effect of climate thereon, but malting conditions can also play a big part. Still more is this so in the case of special malts produced by modifications in the malting process to produce 'amber' and 'crystal' malts, or, for dark beers and stouts, the roasted barleys and malts similar to those which have been used abroad as coffee substitutes. Moreover, a number of special beers are brewed with additions of other cereals, such as malted oats or wheat, and this, too, markedly affects flavour.

The types of malt available to the brewer can be broadly classified on the basis of depth of colour induced by kilning treatments in malting and are listed below in order of increasing colour. An approximate figure for the depth of colour is given for the British malts as an indication of the range.

Colour Number	*British Type*	*Continental Type*
4-6	Pale Ale Malts	Pilsener Malts
6-10	Mild Ale Malts	—
18-20	Amber Malts	Munich Malts
125-150	Crystal (sweet) Malts	—
230-280	Roasted Barleys Roasted Malts	

Malts of all these different types can, within limits, be made from a wide range of barleys, which may also have a wide range of nitrogen contents. Today it is not possible to import brewing barleys into the United Kingdom, but before the last war Britain was the favoured market for the barleys of the whole world and in almost every month through the year barleys arrived from various countries. Among them were the Continental two-rowed barleys, particularly the fine-looking Bohemian barleys, as well as two- and six-rowed barleys from North Africa, Egypt, Syria, India, Australia and, in addition, barleys from the eastern and western sides of both North and South America. Of all these, the six-rowed barleys of California found most favour as suitable for inclusion in the malt mixture used for brewing pale ales.

Nitrogen and quality

From what has been said earlier it will be clear that in all types of barley the nitrogen content is one of the major factors which influence beer; its diverse effects on the malt's use are summarised below:

(*a*) Together with variety and size of grain it determines the 'extract yield.'

(*b*) Together with the variety it determines the ease of 'modification.'

(*c*) Together with kilning conditions it governs the amount of the starch-splitting enzyme diastase and the degree of colour formation by the amino-acid-sugar reaction.

(*d*) Together with malting and mashing conditions it governs the amount of nitrogen passing into the wort and beer and supplies both simple compounds for yeast feeding and complex compounds which

Cocoa—The Present Situation

We have from time to time published information concerning the cocoa industry, which is seriously threatened by disease. Recently a conference was held in London, under the auspices of the Cocoa, Chocolate and Confectionery Alliance, at which the latest developments in the situations in British West Africa and in the British West Indies were described and discussed; from the information which was given at the conference the following account has been summarised.

West Africa

THE situation which has arisen in West Africa as a result of the existence of Swollen Shoot disease is well known; both in the Gold Coast and in Nigeria the industry is in jeopardy as the result of this virus malady, while the position is further worsened through the attacks of certain capsid bugs and the occurrence of Black Pod disease. Methods of controlling these maladies have been worked out, but the chief difficulty lies in their application owing to the conditions under which the crop is grown on numerous widely-scattered smallholdings worked by native cultivators. For the control of Swollen Shoot the only effective remedy is cutting out infected trees and this has encountered much opposition from cultivators.

Progress in Swollen Shoot control

Of recent years the Government have been severely criticised for alleged failure to apply remedial measures with sufficient vigour, but during the past year efforts have been greatly amplified. Much of the opposition to remedial measures, at any rate in the Gold Coast, has been overcome: here the important step has been taken of dividing the country into two regions for control purposes, *viz.*, (*a*) a special area comprising the regions in the Eastern Province, where infection is endemic and massive, and (*b*) a general area comprising the remainder of the territory where infection is still sporadic.

To deal with the special area a separate Government Department has been set up, the main efforts of which are directed to establishing a *cordon sanitaire* around the periphery to prevent the outward spread of the disease, combined with the rehabilitation of the best of the cocoa lands which include some of the best cocoa soils in the world. In the general area the policy of controlling the disease by the continuation and extension of the cutting-out campaign is being vigorously prosecuted by the Department of Agriculture.

Production in the Gold Coast

Cocoa production in the Gold Coast during the past two years has, on the whole, been maintained at somewhere about the pre-war level. This is largely the result of new plantings which have lately come into bearing and which compensate for the heavy decline in production in the special areas. The general trend is shown in the table below, reproduced from a paper presented to the Conference by Mr. R. D. Linton, Deputy Director of Agriculture, Gold Coast.

The largest area of new plantings is in West Ashanti and it is stated that over 10% of the cocoa in that area is under seven years old and not yet in bearing. If planting continues at the existing rate all suitable land in Western Ashanti will have been planted up by 1955.

Future supplies

It is considered that for this reason supplies of cocoa are ensured for some years to come, while it is claimed that very great progress has been made in the fight against Swollen Shoot in the Gold Coast during the past 12 months, and that provided the necessary staff and materials are forthcoming and the attitude of the farmers does not deteriorate the outlook is one for restrained optimism.

The Nigerian position

In Nigeria it has been found that there is an area where the disease is endemic, covering about 245 square miles. It is considered that the control of the disease in this area by a cutting-out campaign is impracticable owing to the density of infection, the scattered nature of the holdings and the opposition of the farmers. It is proposed to confine operations in the future to preventing the spread of the disease from the endemic area to areas where the disease is not yet known to exist and to concentrate on these for future

---

Types of Malt and Brewing—*concluded*

give 'fullness' or 'body,' foam retention and haze to the beer.

For all these reasons the nitrogen content of malts is specially important. The geographical distribution of nitrogen contents of the barleys of the world are broadly indicated in the map on p. 494.

Haziness in beer

Now that the tankard is no longer customary, it is necessary to ensure that beer served in a glass shall be brilliant. Haziness may arise as a result of yeast development, and this must be rigidly excluded from the final beer. Alternatively, slight haze may arise from the precipitation of traces of protein matter originating from the malt; the amounts involved are extremely small—say of the order of 1 oz. of haze-forming protein in 5,500 gal. of beer—and the problems of detection and control are correspondingly difficult. It would appear that this type of haze originates from one particular protein in the barley, the amounts of which are enormously reduced during the brewing processes. It follows that the details of the process exercise a correspondingly large influence on the amounts which remain in the beer. There remains, however, the likelihood that types of barley and malting conditions may also play a part and the choice of malts should be made with this aspect in mind.

Conclusion

The general picture presented by this survey is a world-wide production of barleys for brewing with correspondingly wide variations in their behaviour and biochemical composition, particularly in respect of proteins, due to the influence of the variety grown, the soil and climatic conditions under which they are cultivated, and also to the varying circumstances under which the malting and brewing processes are carried out. In choosing types of malt for brewing different kinds of beer, much depends at present on the skill and practical knowledge of the brewer, but the scientist is groping his way towards a more complete understanding and more certain control of the technical problems of brewing and of producing, consistently, beer which satisfies the consumer's ideal.

(Photos pp. 492 and 493 (bottom) Messrs. Greene, King and Co. Ltd., Bury St. Edmunds, pp. 494 and 495, Chapman and Hall Ltd., London—reproduced from Vol. 2 of Hind's 'Brewing Science and Practice.')

production. Mr. R. Johns, Deputy Director of Agriculture, Nigeria, expressed the view, however, that if the cocoa industry is to survive the outmoded practices of the past must be replaced by more efficient planting methods.

Research in West Africa

Research at the West African Cocoa Research Institute has continued. It has been established that where swollen shoot infection is light, effective control by cutting out can be maintained with only a small reduction in the tree population, but when it is heavy it may entail the sacrifice of the bulk of the plantation. No method of destroying the virus without destroying the tree is known. Work is in progress on the mealybugs which convey the disease and chemical insecticides are being tried; the difficulty is to get them past the protective tent with which the mealybug covers itself. New designs of spraying and dusting machines are being tried and work is in progress with systemic insecticides, the latter being under the auspices of Pest Control, Ltd. Work is also in progress with biological methods of control. The existence of a number of alternative host plants has been established and when Swollen Shoot diseased cocoa trees are cut out, the alternative hosts should also be removed, but it is impracticable to attempt to remove alternative host trees in areas where Swollen Shoot does not occur.

Effective control of capsid bugs on young trees can be secured by painting with DDT emulsion, but the method is not capable of application on mature cocoa. Control of Black Pod can be secured by frequent harvesting and cutting out all pods showing symptoms of the disease.

Work has also continued on cultivation and manuring; the importance of maintaining soil conditions approximating to those in the natural forest has been established; criteria for good and bad cocoa soils have also been determined and a method for mapping cocoa soils rapidly has been worked out and is being applied. The development of higher yielding strains of cocoa, both from local and also imported material, is continuing and it is clear that by using improved material yields can be greatly increased.

West Indies

In Trinidad, which is the most important cocoa-producing area in the British West Indies, the industry declined severely during the years 1920 to 1939, owing to the combined effects of Witches Broom disease and low prices. It was established that of the existing areas much was planted on land not well suited to the crop, while many of the trees were low yielding. Since 1935 efforts to rehabilitate the industry have been in progress. In the early years these met with little success, but more recently research has shown the way to obtain better results. High-yielding clones have been used and methods for their successful propagation by means of cuttings worked out, while strains resistant to Witches Broom disease have also been discovered.

The work is being carried out by the Cocoa Research Scheme attached to the Imperial College of Tropical Agriculture, which has recently been provided with additional resources and equipment, and the Research Division of the Trinidad Department of Agriculture.

Rehabilitation in Trinidad

As a result a cocoa rehabilitation scheme financed from taxation was inaugurated by the Trinidad Government and during the past few years substantial progress has been made. The position was reviewed at the Conference in a paper by Mr. B. G. Montserin, Chief Scientific Officer of the Trinidad Department of Agriculture. It appears that 200,000 plants of improved strains were distributed in 1949 and that by the end of 1950 a further 350,000 plants will have gone out from the departmental nurseries. Already some 1,800 acres of cocoa have been re-established. Planting is being confined to areas where the conditions are naturally suited to cocoa and it is considered that the prospects for rehabilitating the cocoa industry of Trinidad are good. If these expectations are realised it will constitute a notable triumph for scientific methods.

Research in the West Indies

On the research side Dr. H. Evans, Plant Physiologist of the Cocoa Research Scheme, provided an outline of some of the more recent developments, notably an account of his own work on the vegetative propagation of cocoa. He drew attention to the important part played by leaves in this connection and described a new method of propagation, using single leaf cuttings, which gave promise of being capable of utilisation for the large-scale rapid propagation of cocoa. He also described and discussed the technique of mist spraying now in use at the propagating station of the Department of Agriculture at La Pastoria.

He further discussed the influence of trace mineral elements on cocoa in Trinidad and elsewhere in the West Indies and showed that practically all cocoa growing in Trinidad is suffering from faulty iron nutrition; deficiencies of manganese and copper are of frequent occurrence while responses to cobalt applications have been obtained in some localities.

Work on breeding improved types of cocoa has been continued, and attention has been concentrated lately on hybridisation between different varieties and clones to combine in new types high yield with disease resistance and other desirable qualities.

On the plant pathology side work has continued on techniques for testing the resistance of clones to Witches Broom disease while investigations are in progress to assess the possibilities of its control by spraying with copper-containing fungicides. Work has also been in progress on the insect transmission of the virus disease of cocoa which occurs in Trinidad.

Crop Year Annual average	*Total Crop tons*	*Special Area tons*	*Crop %*	*General Area tons*	*Crop %*
1935/36-1939/40	271,349	105,400	38.8	165,949	61.2
1940/41-1944/45	223,973	79,104	35.3	144,869	64.7
1945-46	209,295	56,193	26.8	153,102	73.2
1946-47	192,108	44,567	23.2	147,541	76.8
1947-48	207,559	34,100	16.4	173,459	83.6
1948-49	278,372	55,338	19.9	223,034	80.1
1949-50	250,000*	46,500†	18.6	203,500†	81.4

* 1949-50 Main Crop of 246,000 tons (provisional) plus 1950 mid-crop estimate of 4,000 tons.
† Estimate.

Marshall Aid for Anti-Locust Campaign

Following reports from the Desert Locust Advisory Committee at Nairobi that a large-scale movement of desert locust in the Near East and Africa is imminent, an emergency anti-locust campaign was started in November and will be built up to cover all breeding areas at the beginning of next year.

A large mobile force of American trucks, which will eventually number up to 1,000 vehicles, is being supplied by the Marshall Plan and will mainly operate under desert conditions in the Arabian Peninsula, carrying equipment and teams of skilled and unskilled workers as well as bait and insecticide.

The British Government and British Colonial Territories have allocated over £3,500,000 over a three-year period to provide for staff, equipment and insecticide to check the plague and avert a recurrence of the disasters suffered in 1927-34.

From 36,000 acres sown in 1949-50 in New South Wales about 72,000 tons of rice were harvested

The Australian Rice Harvest

DOREEN HUNGERFORD

In previous issues accounts have appeared of rice cultivation by traditional Chinese methods and of recent attempts to develop the mechanical cultivation of the crop under fully tropical conditions in British Guiana. Here is an article describing the development of rice growing in Australia, and particularly in the Murrumbidgee irrigation area in New South Wales, where in the past 25 years an important industry has been built up, using mechanical methods of cultivation.

RICE production has had a small but useful place in the Australian economy for some time past, and may become an important factor in developing the near-empty north of the continent.

Recently a survey has been made of the possibilities of large-scale rice production in the Kimberley district of Western Australia and the Darwin-Katherine area of the Northern Territory, and the survey has shown that extensive areas could probably be used for growing rice without artificial irrigation.

It had been known previously that large tracts of the north were suitable for rice cultivation, but an expenditure of at least £22,000,000 had then been considered necessary to provide water for irrigation in one area along the Ord River district.

The latest survey was carried out by the Chief of the Division of Plant Industry of the New South Wales Department of Agriculture, Mr. W. Poggendorff, who is one of the agriculturists responsible for the successful cultivation of rice in New South Wales. It was sponsored by the Rice Equalisation Association and had the co-operation of State and Federal agricultural scientists.

Mr. Poggendorff reported that, in his opinion, the normal rainfall and seasonal flooding of areas near Darwin, Wyndham and Derby could provide sufficient water for rice culture without having recourse to other methods of irrigation. He added that to achieve economic production with a minimum of expenditure of labour and money, careful preliminary observations would have to be made on the incidence and depth of flood waters and supplies of suitable tropical varieties of rice seed obtained.

In Queensland, too, prospects for developing the industry are bright. The Queensland Department of Agriculture has announced that suitable conditions for rice growing exist along Queensland's eastern seaboard from Cooktown to Southport, a distance of about 3,000 miles.

Experimental acreages of upland rice, which can be grown without artificial irrigation, planted by private interests in northern Queensland will this season yield from 100,000 to 150,000 lb. of seed. Other varieties for growing without artificial irrigation have been developed by the Queensland Bureau of Tropical Agriculture at South Johnstone, and seed is being supplied to farmers for multiplication on their own properties before beginning rice cultivation on a commercial scale.

Rice farmers in New South Wales have reported a near-record yield as the result of a good growing season and perfect harvesting conditions.

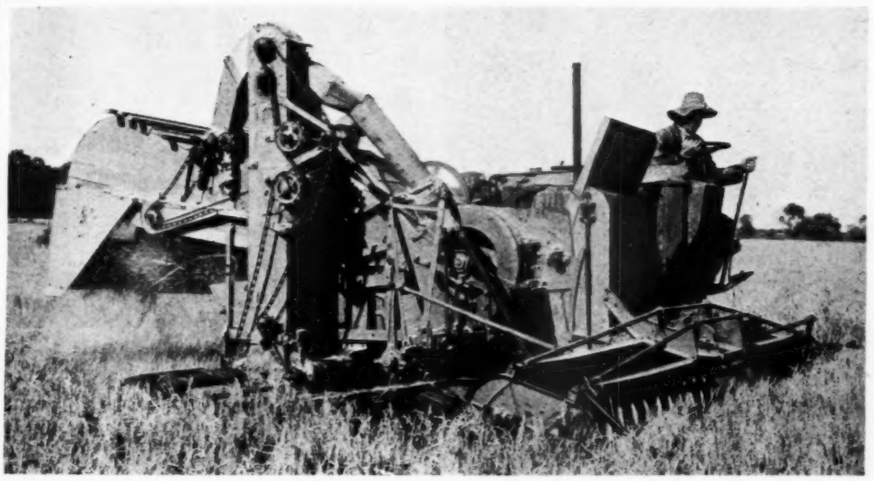
History of rice growing in Australia

Rice has been grown successfully on a commercial scale in Australia since 1924-25, when 157 acres were put under the crop on the Murrumbidgee Irrigation Area.

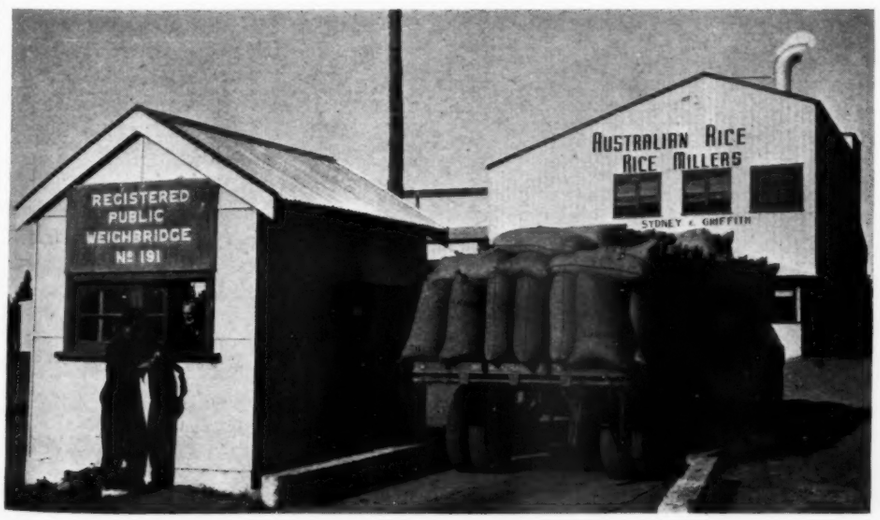
As early as 1891 farmers on the north coast of New South Wales had tried to grow upland varieties under natural rainfall conditions but without success. In 1912 further unsuccessful trials were carried out on land close to bores which tapped underground water supplies.

During the 1915-16 season small trials with upland varieties were carried out at the Yanco Experiment Farm in New South

A rice header operating in the Murrumbidgee irrigation area. The machine has an eight-ft. cut, threshes, winnows and cleans the paddy in one operation



This self-propelled auto-header, having a 12 ft. fore-cut, has been adapted from a wheel-type wheat auto-header and can open up a crop without damage



Paddy rice arriving at a New South Wales mill which has an annual capacity of 50,000 tons

Wales under irrigation, but these also were unsuccessful mainly because unsuitable varieties were planted.

Since the first successful season in 1924-25, the acreage of rice cultivated under irrigation has extended rapidly in the Murrumbidgee Irrigation Area and the neighbouring district, which draw water supplies from the Murrumbidgee River, and in the Wakool-Tullakool area irrigated from canals served by the Hume Dam on the River Murray.

The average amount of water used for the irrigation of rice crops on the Murrumbidgee Irrigation Area is about 6 acre-ft. per season. The actual amount required is influenced by the underlying geological and hydrological conditions, the season, the density of the crop and the lay-out of the field.

Production

Rice production since 1942 is shown in the table overleaf.

The total area in the Murrumbidgee-Benerembah districts having soils suitable for rice-growing under irrigation is estimated to be about 100,000 acres. In the Wakool-Tullakool area also there are many thousands of acres suitable for the crop. Since rotational farming is practised, only from 25 to 30% of the Murrumbidgee area can be cropped with rice each year, while at Wakool-Tullakool the annual sowing is governed by the capacity of the channel system.

Throughout the Murrumbidgee Irrigation Area the crop is grown on shallow, medium to heavy clay soil overlying a stiff clay subsoil which had previously proved unproductive when sown to other crops. This soil has yielded prolific rice crops with an average yield over the past 11 years of 1.8 tons (more than 90 bushels) of paddy to the acre. It has also produced good yields of wheat and oats when grown in rotation with rice; moreover, highly satisfactory returns have been obtained from fat lambs grazed on temporary pastures in the area.

Most Australian rice growers farm enough land to follow a three- to four-year rotational cropping plan, while some even practise six- to seven-year rotations.

Rice varieties

Since 1928 the New South Wales Department of Agriculture has maintained a comprehensive programme of introduction and testing of rice varieties which has enabled farmers to get pure seed for sowing and consequently to ensure even grain ripening and uniform crops.

Resulting from this selective work, two improved heavy-yielding pure strains of

Caloro, known as Caloro II (mid-season) and Late Caloro have been evolved and distributed to growers.

Caloro was developed in California from Wataribune, originally introduced from Japan. It is erect and vigorous, attains a height of about 3 ft., is a good stooler with fairly coarse stems, but has a tendency to weakness towards maturity, particularly if the crop is rank. The grain is plump, flinty and bright and classified as short, medium round.

The original Caloro imported from California and grown in Australia is of slightly earlier maturity than Caloro II, which is of mid-season maturity, ripening in approximately 180 days if grown on land that has previously been cropped with rice.

Late Caloro matures approximately ten days later than Caloro II and, under normal conditions, is a heavier yielder. Usually the hulls of Late Caloro are a little darker than those of the other two strains.

Although Caloro II and Late Caloro are prolific yielders, officers of the New South Wales Department of Agriculture have for some time been seeking to improve the cooking quality of Australian rice. Recently they have developed two new varieties which will, it is believed, not only surpass standard commercial Caloro in quality but also in yield.

The selected variety Colusa 177 has shown great promise, out-yielding Caloro by half a ton to the acre in the first year of testing. This selection produces a very even dense crop with medium-height, strong, willowy straw about 3 ft. high.

Another new variety, a Lady Wright x Caloro crossbred, has also produced heavier crops than Caloro and has the advantage of a medium to long grain of good quality. One slight disadvantage of the Lady Wright crossbred is that it matures about 10 days later than Caloro. The straw is very strong and about 3 ft. 9 in. high.

These two new varieties will be tested again in the 1950-51 season and if still successful may be grown commercially.

Cultivation

Australian rice farmers usually plough during the winter and follow with cultivation to destroy weed growth and produce good tilth. If the land is uneven it is graded to give even watering conditions. Large check banks are built to hold the water on the land and their direction and number is determined by the contour or fall of the land. The fall between banks is usually no more than 3 in. With such a fall the water can be readily controlled and led from one bay to another which gradually refreshes the water throughout practically all the growing period.

A 15 cwt. per hour separator, which detaches the husks from the grain and cleans away dust

The size of the bays is also governed by the contour of the land. On the majority of farms the most convenient size is from four to six acres. Although in very flat country larger bays are sometimes laid out. Since it is usual to submerge the land to a depth of between 6 and 9 in., check banks between the bays are about 18 in. high when first built, and about 12 to 14 ft. through at the base.

Rice is sown in the spring, usually from about the middle of September until the middle of October. Graded seed is used at the rate of 100 to 120 lb. to the acre according to the variety, type of soil, method of sowing, number of crops already taken off the land and the stage of the sowing period.

The seed is sown at a shallow depth like wheat or oats. An ordinary wheat drill or combine is used, the seed being covered by soil in the usual way. To sow Caloro rice the drills are set at half the quantity shown on seeding tables supplied for wheat sowing and the cut-off plates are turned over to the coarse side.

Use of fertilisers

Following an extensive series of manurial trials with artificial fertilisers and combinations of fertilisers at the Leeton experiment farm, agriculturists are convinced that the most satisfactory fertiliser for rice is nitrogen in the form of sulphate of ammonia, applied at the rate of 2 cwt. to the acre on clean land which is free from any appreciable growth of legumes.

If there has previously been a prolific growth of leguminous plants—trefoil or short-term pastures in which clovers or lucerne have been mixed—on temporary pastures grown for fat lamb raising, rice can sometimes be grown without any artificial fertiliser, or the quantity applied is reduced.

When planting is done in cold spring weather or early sowings are made on heavy-textured clay soils, up to 1 cwt. to the acre of superphosphate is sometimes added to the sulphate of ammonia to promote rapid germination and early vigour of growth.

Fertilisers are applied either through the manure box of the seed drill or combine when the rice seed is sown, or by broadcasting in the rice bays after the rice has germinated.

Irrigation

Immediately after seeding the land is irrigated to obtain germination. About a week or two later water is applied again and the young plants are irrigated as often as necessary to keep the land moist until they are about 6 in. high, usually about 30 days after they have shown through the

RICE PRODUCTION IN AUSTRALIA, 1942-1950

Season	Location	Acres	Total Area Sown in Acres	Total Paddy Harvested in Tons	Average Yield Per Acre in Tons
1942–43	Murrumbidgee Irrigation Area ..		34,323	57,153	1.66
1943–44	Murrumbidgee Irrigation Area ..	37,425			
	Wakool	4,104	41,529	75,079	1.81
1944–45	Murrumbidgee Irrigation Area ..	19,793			
	Wakool	4,803	24,596	31,338	1.28
1945–46	Murrumbidgee Irrigation Area ..	24,129			
	Wakool	4,104	28,233	50,806	1.80
1946–47	Murrumbidgee Irrigation Area ..	31,989	31,989	55,366	1.73
1947–48	Murrumbidgee Irrigation Area ..	25,842	25,842	48,847	1.89
1948–49	Murrumbidgee Irrigation Area ..	25,825			
	Wakool	3,287			
	Tullakool	1,753	30,865	50,914	1.65
1949–50	Murrumbidgee Irrigation Area ..	26,795			
	Wakool	7,264			
	Tullakool	2,191	36,250	70,000 (estimated)	1.93 (estimated)

The partially drained main canal which delivers water for rice growers in the Murrumbidgee irrigation area

soil. Water is then allowed to remain on the crop with only the leaf tips showing. In Australia it is not necessary to change water periodically so long as the amount lost by evaporation, transpiration, etc., is renewed.

When the last few grains towards the base of the head are out of the milk stage and in full dough stage, no more water is allowed into the bays. As the crop reaches maturity the water evaporates. If the paddy is ready for harvesting before all the water has gone the remainder is drained off.

Pests and diseases

Strict quarantine restrictions on the importation of rice seed in bulk have so far kept Australian rice crops free from infection by fungus diseases although they are occasionally attacked by insect pests and birds.

The rice beetle (*Laius femoralis*) sometimes attacks crops in the early stages. Control has been established by fluosilicate dust and with DDT. Caddis fly (*Trichoptera*), the rice stem borer (*Phragmatiphila sp.*), the egg masses of aquatic beetles and grasshoppers cause some little damage but have not affected yields to any great degree.

Each year rice crops suffer from the attacks of birds, coots and wild duck being the worst offenders. Growers are given some protection by the opening of a special season for wild duck from October 1 to December 31 in rice-growing areas.

Weeds

The most serious problem of the Australian rice farmer is weed growth. Soil and climatic conditions in the Murrumbidgee and Wakool areas favour growth of Cumbumgi (*Typha Muelleri*), cat's tail (*T. augustifolis* var. *Brownii*), water or barnyard grasses (*Echinochloa crus-galli* and *Panicum colonum*), slender or wild aster and rushes and reeds. If weeds are not strictly controlled they can, within a very short period, make the land useless both for rice and other crops.

Where infestation is heavy, farmers find that weeds can be controlled or eradicated by early flooding. The seed is sown shallow at a depth of about 1 in. and germinated by irrigation in the usual way. When the maximum germination has been obtained the rice seedlings and weed growths are totally submerged to a depth of a few inches above the plants.

With this treatment barnyard grasses turn yellow quickly and die. Sometimes the rice plants become an unhealthy colour too, but they gradually recover as they reach the surface of the water.

Where soil types are suitable for the operation some farmers after sowing a little deeper than usual prefer to harrow the ground after germination flooding has been drained off. This practice controls weed growth.

When their early-sown rice fields become badly infested with barnyard grasses, some farmers drain the water from the bays as soon as the weather becomes warm and put in enough sheep to eat off all plant growth quickly within seven to ten days. The sheep are then removed and the bays filled to capacity. Although this treatment delays maturing of the rice, it does not affect the rice plants so long as it is carried out quickly while the weather is warm.

Harvesting

Rice harvesting operations generally begin towards the end of March, but crops are usually stripped during April, May and June.

In the early days of rice growing farmers experimented with ordinary wheat headers to harvest their crops quickly and economically. The success of these experiments encouraged Australian machinery firms to build rice headers, which are side-cut auxiliary-driven tractors or horse-drawn headers with 8 to 12 ft. cuts.

The machines cut, thresh, winnow and clean the paddy in one operation. They are fitted with large grain boxes and bagging platforms so that the grain can be bagged while the headers are moving through the fields.

Several fore-cut automatic headers on crawler tractors have been used with success during recent seasons. The fore-cut machines have the advantage that they can enter a crop without damage in opening up whereas side-cut headers destroy a proportion of the crop by trampling the initial cut around the banks of each bay. Most growers in the Murrumbidgee Irrigation Area have therefore adopted the practice of employing contractors with fore-cut auto-headers to cut tracks around each bay. Usually eight miles of track are cut to each 100 acres of rice, the cost being about £8 a mile.

The bagged grain is stacked on the edge of the fields for collection by trailer units and transport to local rice mills or to the railhead from which it is despatched to rice mills in Sydney and Melbourne.

Disposal of the crop

Immediately rice crops are harvested the Australian Rice Marketing Board, which was established in 1928, takes possession of all marketable paddy and disposes of it to the best advantage. As the Board handles all the rice produced a close estimate of requirements can be made each season before seeding operations, and the maximum area to be sown by all farmers is then fixed by the Board in consultation with the Water Conservation and Irrigation Commission which supplies irrigation water and representatives of the rice growers themselves.

Laboratory Extensions Opening

Laboratory extensions for the technical department of Plant Protection, Ltd., were opened at Yalding, Kent, on October 17 by Sir Wallace Akers, Research Director of Imperial Chemical Industries. These new buildings will enable more efficient development and formulation of ingredients into products suitable for agricultural and horticultural use to be carried out.

Before formally declaring the extension open Sir Wallace gave a short account of the company's history in the field of protecting plants against pests, diseases and weeds. There were over 700,000 species of insects known to entomologists, he said, and 7,000 new ones were being found annually. Fortunately, not all of these were harmful to crops, but, in order to fight the pests amongst them, more and newer chemical compounds were being investigated for properties toxic to harmful insects, fungi and weeds.

The extensions consist of a chemical laboratory for formulation work, an analytical control room for testing ingredients and finished products, and a semi-works scale laboratory where miniature machines, replicas of those used in the main works, can turn out specimens of powders and emulsions for testing. Four types of formulation are carried out: dusts, wettable powders, miscible oils and ' mayonnaise ' emulsions. As an example, gammexane, DDT and sulphur have been formulated under the first category into a dust, which is suitable for spreading from an aircraft—not too light and not too heavy. This dust is now being used against cotton pests in Egypt.

In the analytical laboratory visitors watched the extraction of ' Tuberite,' the potato sprout suppressor, and the analysis of gammexane BHC by hydrolysis. Another problem being tackled in the laboratories is that of corrosion to containers of these various chemicals; lacquering of tinplate containers was found to be partially effective, but aluminium has been the most suitable metal used so far. Other work includes the testing of hops for arsenic content and the testing of new compounds.

Among the guests at the opening were Sheik Hafiz Wahba, K.C.V.O., Ambassador of Saudi Arabia; M. Gamil A. Setouh, Agricultural Attaché to the Egyptian Embassy; Mr. Benjamin Ekalou, Professor of Chemistry at Calabay; and Mr. K. W. Serenkuma, Agricultural Adviser to the Buganda Government.

A view of the new semi-works scale laboratory of Plant Protection, Ltd., at Yalding, Kent

Fertiliser Congress to be in Italy

The second World Fertiliser Congress will be held in Rome from October 22 to 25, 1951. It is being organised by the International Centre of Fertilisers under the auspices of the International Confederation of Technical Agriculturists.

The Congress will be organised into five sections covering: (1) fertiliser production (research and manufacture), (2) technique of the use of fertilisers, (3) economics, (4) publicity, (5) special questions, including soil conservation and liquid manuring.

Twelve countries have been delegated by the Board of the I.C.F. to present reports on a wide variety of subjects, *e.g.* fertilising of fruit and market garden crops (United Kingdom), fertilising of arid soils (Spain) and fertilising hilly country (Switzerland).

Further information concerning the Congress can be obtained from the Office of the Congress Organisation Committee, Via Barberini 86, Rome.

U.S. Fertiliser Exports Decreasing

According to the U.S. Department of Commerce, exports of fertilisers from the States are likely to show a downward trend from the very high post-war level. The army programme for occupied areas has already begun to taper off, especially nitrogenous materials. Production is increasing abroad and the exchange situation is making it difficult to expand foreign outlets. A small increase in fertiliser imports is predicted by the Department.

Dairy Show, 1950

The 64th annual show of the British Dairy Farmers' Association was held at Olympia, London, from October 24-27. Attendance (96,867 visitors) was not up to last year's record of 102,097 as was to be expected. Attendance at most agricultural shows this year has fallen and it seems that the post-war show boom may now be over.

Although 851 animals were entered, only 293 actually appeared at the show; this must have been a disappointment for the organisers who had erected stalls to hold well over that number.

The British Dairy Farmers' Association supreme championship challenge trophy was awarded to an Ayrshire cow, which was also the winner of all breeds in the milking trials. This was heartening for the Ayrshire breeders, since last year the trophy was won by a British Friesian. However, the Bledisloe challenge trophy (awarded to the breed society adjudged to have the best exhibit of good all-round dairying cows) was won for the third successive year by British Friesians by the narrow margin of one point.

The machinery stands were well attended and covered the whole dairying field from milking machines to bottle cappers and ice-cream machinery. From the crop production point of view, fewer exhibits appeared than last year; grass-drying plants, for instance, were conspicuous by their absence.

In the gallery above the main show ring were displays of bacon, butter, cheese and eggs to delight the eye and quicken the appetite. The Canadian Government, too, had a stand displaying some fine examples of high-grade produce from that country.

Electric Fencing

J. H. L. KNOCKER, A.M.I.B.A.E., Dip. Agric. (Wye)

Electric fencing is a comparatively recent development which has already proved its value as a means of controlling grazing easily and cheaply. However, it has its limitations: for example, experience, especially in overseas countries, has shown that it is more effective in keeping grazing animals within confined areas than in excluding wild animals from cultivation. An account is given in this article of both the capabilities and limitations of this type of fencing.

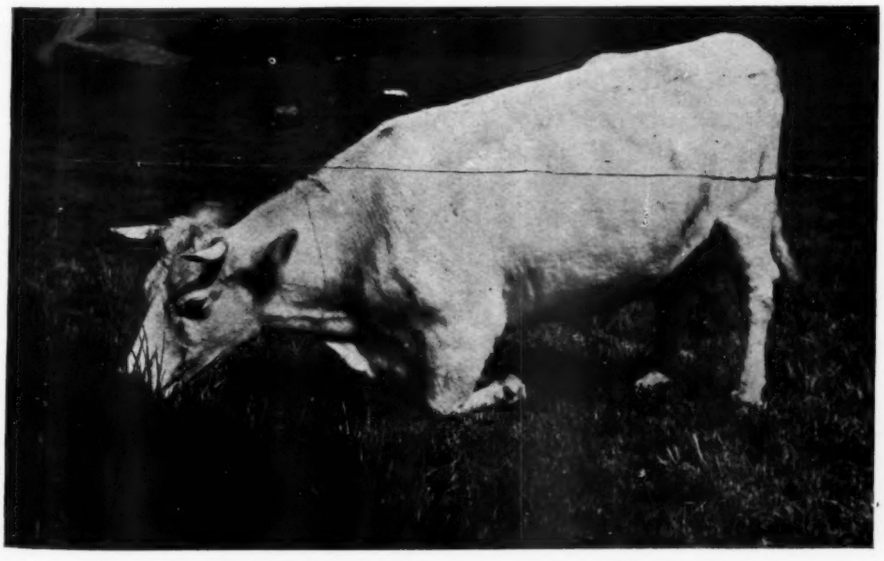
THE introduction of the electric fence to Great Britain 13 years ago was greeted in agricultural circles with the usual polite scepticism that is accorded to most newfangled ideas, and few people envisaged the widespread popularity this novel method of restraining livestock would achieve. Nevertheless, it soon became apparent that most animals were susceptible to an electric shock and that a single wire charged with electricity would prevent an animal from straying, where previously it had required three and four strands of uncharged wire or even stronger fences. After the initial introduction to the sting of the electrical shock there was no doubt that the animals' respect for the fence was largely psychological rather than physical and in some cases it was found that after the fence had been in use for a few days it was possible to switch off the current, and the fence still carried out its purpose. This substitution of one wire for three or more, together with the fact that it was not necessary to have so many posts, because the wire did not have to be absolutely taut, made the erection of the electric fence not only cheaper but quicker: materials and wire were saved, labour was reduced, both matters of paramount importance in time of war, and the electric fence got a firm foothold in British agriculture within five years of its introduction into the country.

The same advantages hold good today, when the cost of erecting a post and rail fence to enclose an area of five acres would be in the neighbourhood of £250, while a three-strand barbed-wire fence, probably the cheapest alternative to the electric fence, would cost £40 for materials alone, compared with a cost of no more than £20 for the complete electric fence.

Modes of operation

In America some of the controlling or energising units are operated by the electric mains supply, but this is considered to be too dangerous in this country and in any case limits the value of the fence by making it essential that the wiring goes back to the homestead, thus lowering the adaptability of the fence. In Great Britain, therefore, most units are battery operated, the voltage of the battery usually being no higher than 6 volts, thus doing away with any possibility of danger to either the animals themselves or to human beings accidentally coming in contact with the wire.

All British energising units are of the inductive-discharge type with mechanical interruption of the primary current. The unit shown in Fig. 1 (overleaf) contains a balance wheel, W, carrying one of the make and break contacts of the primary circuit. Control torque is provided by a relatively weak spiral spring, S, which is adjusted to close the contact when at rest. Immediately the unit is switched on current is supplied by the six-volt accumulator or dry battery, to the primary winding of the transformer or magnetic system, T, via the contacts, C. The armature, A, is then attracted to the iron case of the magnetic system and imparts an impulse to the balance wheel, W. This wheel then rotates against the torque of the control spring, S, for a fraction of a revolution. The contacts are thus opened and the primary current interrupted. The balance wheel returns under the action of the control spring and the whole cycle of operations is repeated for as long as current is available from the battery. The amount of current taken is very small, an ordinary six-volt accumulator or dry battery being all that is necessary to charge 20 miles of fencing under normal conditions.



This cow grazed the whole length of the wire on her 'knees'—an instance of the thoroughness of controlled grazing

Construction of fencing

The fence itself may consist of one or more strands of plain wire attached to insulators on suitable metal or wooden posts. The output terminal of the controlling unit is connected to the fence wire and the other to earth, thus providing the return half of the complete circuit. The voltage impulses are applied across the wire and earthed, but very little current flows, unless there is a leakage, until an animal making contact with both wire and earth completes the circuit. From this it may be seen that it is essential that no other contact between wire and earth

should be allowed, apart from the original circuit, or leakage will occur, and the accumulator providing the electricity will run down in a short time, rendering the fence useless, until it is recharged or replaced with a freshly-charged battery.

Precautions

Constant attention must therefore be given to see that no vegetable growth of any kind is allowed to grow up and touch any of the fence wires, care being taken as well, not to lean metal objects against the fence, and to see that the circuit is not left uncompleted by leaving the 'gate' improperly attached or lying on the ground. 'Gates' for electric fences are extremely cheaply and easily made, consisting merely of a single strand of wire, attached to an insulator on one post, stretching across the gap and hooking on to a wire loop attached to an insulator on the second post. In order to keep the 'gate' taut, and to make sure of a good contact between the hook and the loop, a tension spring is inserted in the 'gate' wire and an insulated handle made of wood or rubber hose is provided to prevent anyone handling the 'gate' from receiving a shock. The arrangement is shown in Fig. 2.

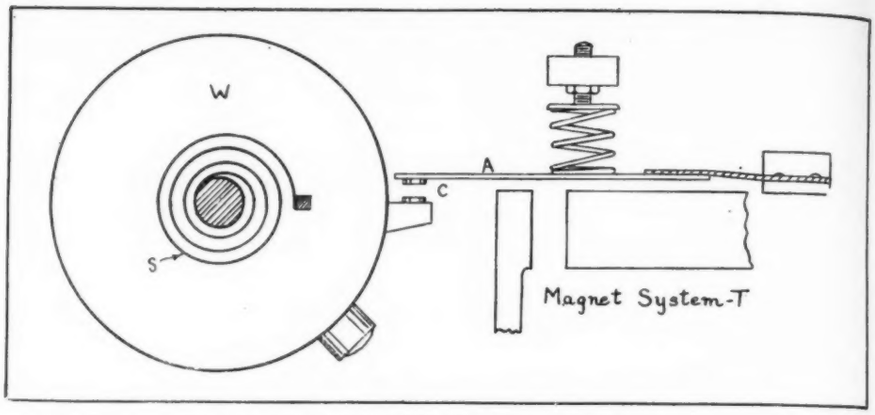


Fig. 1—The mechanical impulse system

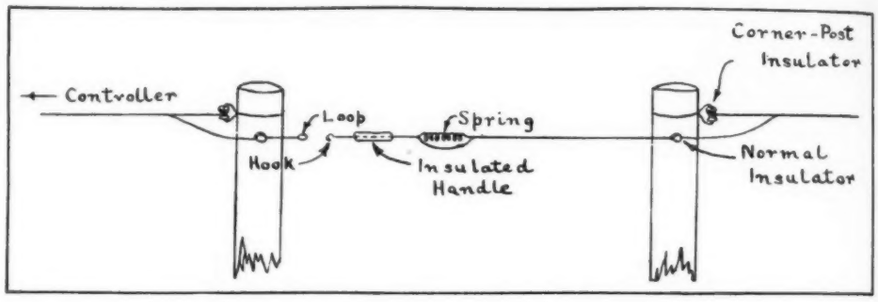


Fig. 2—Arrangement of the 'gate' of an electric fence

Wiring

To enclose most types of animal one strand of wire is usually sufficient and this should be placed at a height equivalent to about three-quarters of that of the animal, but pigs, particulary young ones, often require two strands, one about six inches from the ground to prevent them crawling underneath, and one a foot higher to stop them jumping over the lower wire. Plain wire is normally all that is necessary but in the case of sheep and goats, whose thick coats protect them to some extent from the shock, barbed wire is more effective.

In the majority of early electric fences the wire was carried on porcelain insulators, which are nailed, screwed or bolted on to light wooden or iron stakes: as these stakes have to be driven into the ground, the system presents a number of disadvantages. Once the stakes are properly driven in, much time is lost in extracting them, when the fence has to be moved and, frequently, the stakes break in the process; the insulators, if not removed before the stakes are driven in a second time, break under the blows of the hammer and have to be renewed. On the other hand, the removal and refitting of the insulators is a lengthy process but today these drawbacks may be avoided by the use of light metal stands, with insulators attached, which do not require to be driven into the ground; in addition it is now possible to obtain unbreakable insulators. Other useful pieces of equipment to lighten the labours of the electric fence erector are reels to hold and transport the wire, doing away with the incomprehensible tangle into which wire is so fond of getting after use, and anchor posts for the ends of the run, which may be fixed in a matter of seconds.

With these modern accessories it is possible for one man to take down and re-erect a 200 yard electric fence in under 30 minutes and there is no doubt that this flexibility is largely responsible for the popularity of electric fences in controlled grazing. Large fields may very simply be divided by electric fences into more or less permanent small paddocks, or the grazing may be controlled still more efficiently by moving the electric fence once or twice a day. It is now well known that grass contains more protein and is therefore of most value when it is about six to eight inches in height and it has been found that at this stage of its growth an acre of grass will carry from 50 to 80 cows; cattle controlled by an electric fence will get the greatest benefit from this growth without waste and the yield of the pastures themselves may be increased by as much as 25%.

Folding kale

Grass is not the only crop that can be rationed and dealt with profitably in this way; the suitability of kales as winter fodder for dairy cattle has been well known for many years, but the harvesting of the crop has always been a serious drawback to the growing of it. Mechanised methods of harvesting kale have not proved to be economic except on the largest acreages and in consequence on nearly all farms the kale has to be cut and loaded by hand. Apart from the fact that the farm workers, not unnaturally, dislike handling the soaking wet and frequently frozen crop, it wastes a great deal of labour and raises the cost of growing the crop considerably. Folding the cattle on the kale by means of an electric fence not only does away with all the unpleasant handling and the labour of cutting and carting, but also saves the field from a great deal of 'stodging' by the wheels of the tractors and trailers previously used for carting. This in itself is a very definite asset and when the fact that the cost of growing and utilising the crop is almost halved when it is folded is taken into consideration it is evident that the electric fence pays for itself in a very short time.

When folding kale the fence is normally erected across the field, allowing the requisite quantity of food per animal, but in grass fields there are a number of methods which may be adopted to save labour and time in moving the fence. Fig. 3 (*a*) shows one of these methods, whereby only one end of the fence is moved at a time,

and the controller, placed on the first day at point A, does not need to be moved more than once every two days. The fence runs from A to B on the first day, from A to C on the second, and from C to D on the third day, the controller then being moved to point D. This method works well in fields which are roughly rectangular in shape, while the method shown in Fig. 3 (*b*) is most useful in square fields. There the controller is placed in the centre of the field at A and not moved at all; the fence AB is erected and left standing all the time the field is being grazed, while one end only of the ' movable ' fence AC is moved each day from C to D and so on until only one section is left, when the ' movable ' fence is taken away, leaving the fence AB to control the cattle for the last day, if necessary.

Folding cattle over kale by means of an electric fence saves much time and labour which would otherwise be used in cutting and carting

Crop protection

So far only the control of animals inside a fence has been dealt with and no mention been made of the use of an electric fence to exclude animals, such as rabbits, from growing crops. Actually, some of the earliest experiments with electrified wires were made on rabbits, which were found to be very susceptible to an electric shock and this knowledge has been put to good use in fencing against them since those early days. This spring, an electric fence composed of three strands of electrified wire, six inches apart, the lowest wire six inches from the ground, was almost completely successful in protecting a field drilled with spring oats from depredations by rabbits in East Anglia. One side of the field was bounded by a wood, known to be infested with rabbits, but only at one point where there was a slight depression in the ground midway between two posts, did rabbits pass the barrier, and here there were signs that they had crawled under the fence. The fence was erected along the woodside headland only, close to the hedge, and in order to reduce the risk of the fence being short-circuited by the crop or weeds growing up and making contact with the wire, the headland was ploughed to a shallow depth close up to the roots of the hedge which skirted the wood. It is interesting to note that the fence required no attention, not even the recharging of the battery, over a period of two months, by which time the oats had grown tall enough to make protection from rabbits no longer a necessity. The fence was carried on for a short distance round each corner of the field and this seems to have been sufficient to dissuade the rabbits from running round the ends of the fence.

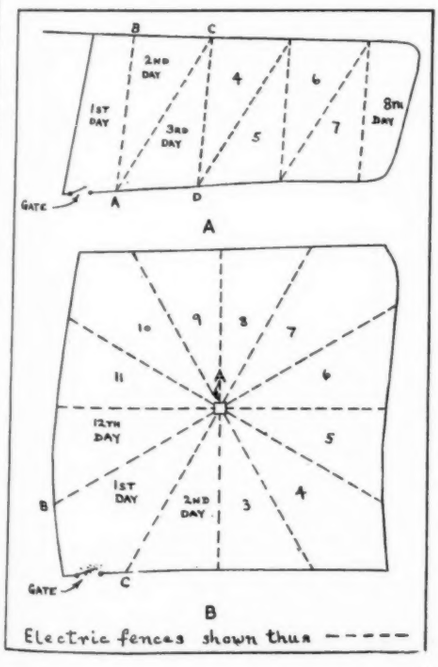


Fig. 3—Controlled grazing (a) rectangular field; (b) square field

Electric fencing overseas

Evidence of the efficacy or otherwise of the electric fence in foreign countries and in the Commonwealth is hard to come by and, frequently, contradictory: Denmark, with its large acreage devoted to dairy farming, is undoubtedly the country in which electric fences have achieved the most popularity, practically 40% of the farms in that country making use of them. This is no doubt largely due to the fact that Danish fields are large and lack divisions of any kind, but it also stresses the fact that the men who most appreciate the value of the electric fence are those who have herds of cattle to enclose and protect.

Australia and New Zealand

This conclusion brings us automatically to a consideration of those two cattle and sheep raising countries, Australia and New Zealand, in both of which the electric fence has achieved considerable popularity. In these countries, prior to the introduction of the electric fence, the usual method adopted to control cattle and sheep was by the erection of a five- or seven-strand wire fence. The cost of erecting such a fence at present-day prices is very high; wire, posts, staples and fencing labour are not only expensive but also difficult to obtain. As a result, farmers have found it hard to maintain fences in a good state of repair, let alone consider the erection of new ones, and any means whereby fencing costs may be substantially reduced and the limited quantity of materials available made to go as far as possible is welcomed. It certainly appears that the electric fence is proving to be at least a partial answer to their fencing problems. Difficulties have arisen through the excessive agility of the cross-bred sheep, common in Australia; they are capable of going through a five- or seven-strand wire fence with the greatest of ease unless the fence is in good order, and this has meant that the single or double stranded electric fence is not sufficient except in small areas where the paddocks can be closely watched. On the other hand, single and double stranded fences are being used in Australia to keep foxes out of properties, one more example of the use of the fence to keep animals out

as well as in. There, too, the fence is much in favour as an aid to rotational grazing—the temporary as well as the permanent fence.

South Africa

The electric fence has been tried out in Africa and has met with varying success. In South Africa, for instance, it is proving effective in the case of cattle and pigs for the control of grazing on cultivated pastures. It is effective, however, only as long as the paddock in which the animals are running affords good grazing. Towards the end of the grazing period in a particular paddock, there is always the danger of a break-through to adjoining paddocks with more abundant or lusher pasturage. With sheep, particularly the long-wooled types, results are distinctly disappointing, even with barbed wire, while attempts to confine game to certain areas by means of electric fencing, have also proved unsatisfactory.

East Africa

Further north, in East Africa, the problem of game and the electric fence crops up again, but here not so much in keeping wild animals in one area as in preventing them from entering cultivated areas or fields stocked with domestic animals. In one district in Tanganyika, under the Northern Province Wheat Scheme, 15,000 acres of wheat were sown on what had been grazing grounds for Masai cattle and wild game: a trial fence over a mile long was erected and while this was successful in keeping out the Masai cattle the game had to be shot at for some time before they stayed away. Even then, gazelles came in on some areas during the night, and grazed destructively. In game country any fencing stands a bad chance of survival, as it so often gets charged by stampeded herds of larger game, such as zebra or wildebeeste. To minimise this danger, the wire is sometimes suspended from inclined posts so that it swings lightly loose, the ends not firmly fixed, so that if the wire is gently run into there is sufficient give for the wire to go with the animal, which may then be frightened by it and turn back. A ditch as protection to the fence has been tried as well, but this, of course, increases the cost of erecting the fence considerably, even if it is dug by native labour.

Under extensive ranching conditions it has been found that the long grass, which is frequently encountered on the open plains where ranching is practised, not only short-circuits the current but also hides the wire from the animals, so that they break through it, without seeing it.

The National Parks Trustees have used electric fencing in conjunction with the standard five-stranded barbed-wire fence with the object of preventing the passage of animals, such as lions, between the strands of the ordinary fence, with a reasonable amount of success.

Effect of climate

In addition to these difficulties the climatic and soil conditions of Africa and other hot countries have a very marked effect on the efficiency of the electric fence. In the dry season, October to March, the soil loses all its moisture and in consequence the earthing of the fence often becomes totally inadequate. Under these circumstances great care must be taken to see that the shock is stepped up, and it may be necessary to install an earth return wire as a safeguard. The simple method of pouring a bucket of water over the earth wire every day is tedious, even though it may be efficient under these conditions; also, the heat of the sun causes the electrolyte in the battery to evaporate very rapidly and it is essential to keep the battery protected from the sun by a thatched cover, which should preferably have sides as well as a roof.

Conclusion

To sum up, it certainly appears that there is a place for the electric fence in farming today, not only in this country, but in any part of the world where domestic animals are kept and require keeping within bounds. For cheapness of erection, and ease of removal to new sites it cannot be beaten and it is difficult to foresee how, with modern ideas in regard to rotational grazing, with the proof of its efficacy before our eyes not only in the field but also in the pail, anything simpler can be devised.

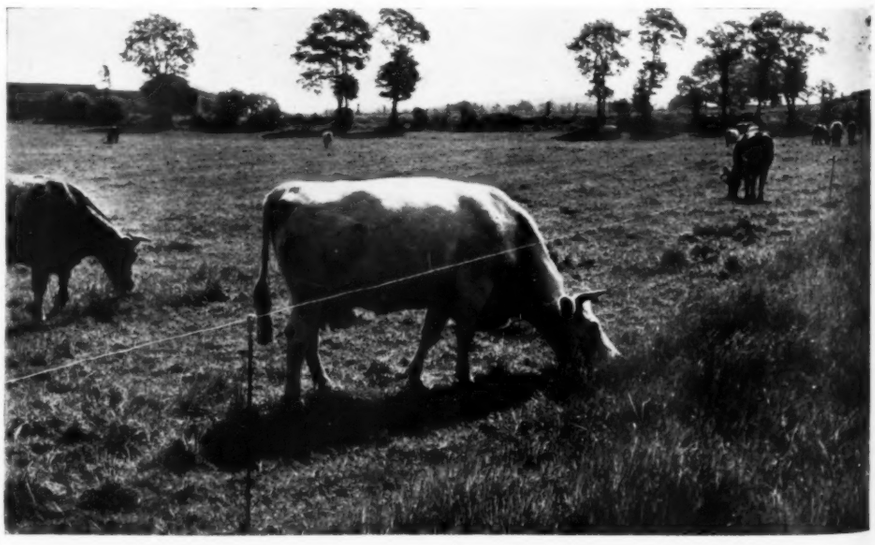
What does appear to emerge from a consideration of electric fencing is the fact that as a means of keeping livestock in it is successful, but as a means of keeping animals, of any size, be they as small as rabbits or as large as elephants, *out*, the electric fence still leaves something to be desired. It may well be that the secret of the fence's success lies in training the animals to respect its powers and, since with wild animals this cannot be done, it must remain an encloser rather than an excluder.

(Photos: Wolseley Sheep Shearing Machine Co. Ltd. Figs. 1 and 2 from the Report (ref. W/T. 18) of the Electrical Research Association.)

Need for Basic Research in U.S.

'2, 4-D would never have been discovered by someone who set out to find a weed-killer,' said Dr. James G. Horsfall, Director of the Connecticut Agricultural Experiment Station, speaking at its 75th anniversary. He was emphasising the importance of basic research, rather than the application of ideas already developed, to the future of science.

'It (2, 4-D) was discovered by those who wanted to know why plants grow upward,' he continued. 'It is a close relative of the naturally occurring chemical that is responsible for plants growing upward.' The weed-killer 2, 4-D was merely a side-product of the original research project.



Cattle soon get to know just how near the fence they can go without receiving a shock

Brazil's Cotton Industry

Col. C. E. PONSONBY, T.D.

Sorting seed cotton in a Brazilian field prior to ginning

Of recent years the Brazilian cotton industry has undergone phenomenal expansion. From being a comparatively unimportant producer twenty years ago the country has become the fifth largest in the world, most of this expansion having occurred during the thirties of this century. The circumstances of the industry are described and discussed in this article, which is reproduced by permission from the Journal of the Empire Cotton Growing Corporation.

COTTON was grown in Brazil even before it was grown in the U.S.A. In 1750 the planters of north-eastern Brazil brought in natives of India to train their slaves to grow and spin cotton. The states of Bahia, Pernambuco and Maranhao were the first to supply the needs of the districts and then of exports, which increased until about 1820, after which period the U.S.A. practically captured the export market until the American Civil War. During the Civil War little cotton was exported from the U.S.A. and world cotton prices rose to record levels. Brazil took advantage of this and the export of cotton reached 355,000 bales, produced by white planters with slave labour. But instead of establishing their industry on a permanent basis, they allowed the U.S.A. to regain their former preponderance, while the north of Brazil reverted to sugar and the south to coffee.

By 1889, when slavery was abolished, plantation cotton practically came to an end, and from that time onwards cotton was grown only by small cultivators to meet local demands.

Expanding textile industry

About 1900 the Brazilian textile industry began to expand and the resulting local demand, together with the low prices of coffee, rubber and other crops then prevailing, again stimulated interest in cotton growing. It was still almost entirely for local consumption, and as the population increased so did the textile mills. By 1920 the spinning and weaving industry was equal to that of Belgium or Switzerland, having 1,700,000 spindles, more than 60,000 looms and employing 130,000 hands. At that time the value of cotton manufactured goods equalled the value of the coffee crop.

The Brazilians came to realise that they could not rely on one or two crops, such as coffee and rubber, for the adjustment of the balance of trade. Rubber, as an export crop, was disappearing, since it could no longer compete with Asiatic plantation rubber. Coffee, of which three-quarters of the world's requirements was grown in the state of São Paulo, was no longer finding a free market owing to the poverty of purchasers in Central Europe. The small sugar exports were being reduced owing to price competition, especially from Cuba. Another crop for export was essential, and the high yields per acre pointed to cotton as the most suitable crop to fill the gap.

The First International Cotton Mission

In 1919 a Brazilian Commercial Mission came to Europe to interest the European cotton-spinning industry in Brazilian cotton, and as a result an International Cotton Mission visited the country in 1921 and made a prolonged tour through the cotton-growing states of São Paulo, Minas Geraes, Bahia, Alagoas, Sergipe, Pernambuco, Parahyba and Rio Grande del Norte. (The remaining states in the north, Piauhy, Ceara, Maranhao, Amazonas and Goyas, were visited by Mr. Arno S. Pearse, who wrote accounts of both visits, in 1923.) These reports are as exhaustive as they are critical and, although, as will be mentioned later, the emphasis on cotton has shifted from the northern districts to the São Paulo districts, some excerpts from the report are interesting when compared with the report of Mr. Norris (U.S.A.), to which reference is made later in this paper:

General. ' Hardly anything has been done to improve cotton cultivation in Brazil. . . . In almost every place I had to explain to planters, farmers, even to some cotton merchants, what constitutes the quality or value of cotton. . . . What Brazil has produced . . . has been achieved without the least human effort towards improvements. All is the spontaneous work of bountiful natural conditions. . . . Man has retarded, has persistently caused a deterioration of the cotton qualities, through laxity or ignorance, as, for instance, in the ginning and in the planting of mixed cotton seeds in the same field.'

Yields. ' The yields per acre of lint in Brazil (especially in the state of São Paulo) are almost phenomenal. . . . Though it is difficult to obtain exact information as to yield in any country, yields of 500 lb. of lint per acre in São Paulo and Rio Grande del Norte are no exception. Ceara, Parahyba and Bahia frequently show yields of 200 to 250 lb. Compare this with 90 lb. for India and 142 lb. for the U.S.A. and

bear in mind that the high yields in Brazil have been obtained without any aid, and you will realise what opportunities Brazil offers as regards cotton.'

Types. In Brazil there are two district zones. In the south or centre portion (mainly São Paulo) American Upland, planted annually, is grown with a staple of about $\frac{7}{8}$ in. to $1\frac{1}{8}$ in. A mixture, in which the American type predominates, is grown in the states of Minas Geraes, Bahia, Alagoas, Sergipe and a part of Pernambuco. In Alagoas, Sergipe and in Maranhão only three months elapse between planting and picking. 'There is no other country in the world where cotton can be grown in so short a period.' In the northern states long-staple cotton is grown on trees which last for at least seven years and often longer.

Pests. The bollweevil (*Anthonomus grandis*) does not exist in Brazil.

The pink bollworm (*Platyedra gossypiella*), known locally as 'lagarta rosada,' and said to have been introduced about 1913 in a shipment of seed from Egypt, in 1919 devastated a large part of the crops, especially in São Paulo. Counter-measures, such as the use of fumigating chambers and disinfected seed, have been taken. Small cultivators employed a simpler method. 'They spread out the seed to be planted in the midday sun for about three hours at a temperature between 60° to 68°C. Some mixed sand and also charcoal for the purpose of better retaining the heat.' It was estimated that in this way 90% of the insects were killed.

Brazil, especially São Paulo, also suffers from the cotton worm (*Alabama argillacea*), known locally as 'Churuquere,' which feeds entirely on the young leaves and shoots. The Agricultural Department supplies large quantities of Paris green. If the plants are sprayed early, infestation does not develop, as a rule, in the south before the bolls are formed and begin to open. Once this stage has arrived it cannot do much damage.

The cotton aphis and ringworm in Brazil do rather less damage than in other cotton countries.

Seed. At the end of the tour of the International Commission Mr. Arno S. Pearse gave a synopsis of their impressions in a speech at Rio de Janeiro on August 16, 1921. He thanked their hosts, he praised their climate; he dilated on the possibilities for cotton, but he emphasised that their chance of creating a big export market in competition with other countries was negligible if they did not take trouble over classification by grower and merchant. 'You have no cause to complain of any shortcomings of nature, but you must recognise the utter laxity displayed by those whose duty it is to grow and handle cotton. Once you have overcome your own personal shortcomings there is no reason why Brazil should not become one of the largest sources of supply of cotton.' He pointed out that practically no effort was made to separate the seed and three or four varieties were being grown together in one field, 'with the result that picking gives short and long fibres, coarse and silky ones.' He pointed out that if 20-mm. and 40-mm. fibres were mixed the price would be based on the 20-mm.; but, worse still, European buyers could never rely on uniformity in repeat orders. He recommended in the strongest possible terms the establishment of seed farms, owned or controlled by the Federal Government, for the production of seed best suited to the conditions of each zone.

Government encouragement

These most forthright and frank reports of 27 years ago had their effect. From 1930 onwards the surplus production of coffee all over the world made it increasingly difficult for Brazil to sell her coffee, while low prices were making it uneconomic to pick it. The Government, by various means, supported coffee prices, but at the same time adopted a policy of diversification of agriculture. In the state of São Paulo cotton became a substitute crop for coffee and, to ensure its adoption, the São Paulo Government not only established a special rate of exchange for cotton exports (to enable exporters of cotton to sell at the world price, while paying a higher price to the growers), but also, through a high tariff, was able to keep foreign textiles out of the country. Since about 1933 the local textile mills have supplied over 90% of the cotton goods in the country. The Government gave other encouragements. Loans were made to support the price and, indeed, at one time the Government itself became the owner of 200,000 bales. Cotton machinery was admitted free of duty. The results of this policy, as affecting São Paulo, are shown in table 1. The situation was, of course, intensified by closed export markets during the war.

These figures demonstrate the effect of the drive for cotton in the early thirties, assisted by the attraction to Brazilian cotton of foreign capital mainly from the U.S.A. and the Argentine. During the intervening period, however, production in the northern states decreased, and cotton in the south, mainly São Paulo, increased.

Exports

From 1930 onwards the export trade developed and flourished. The figures in table 2 are taken from the Economic and Financial Statistical Service, Ministry of Finance, Brazil. The São Paulo figures and the figures from other states are shown separately. (Bales of 500 lb. gross weight.)

Owing to closed export markets the war years are omitted.

British importers took 31% of all South American cotton sold abroad during the first half of 1949. Under the trade agreement with Brazil of August 5, 1949, Great Britain has agreed to take 280,000 bales of raw cotton besides some linters and waste.

TABLE 1

SAO PAULO COTTON: AREA, PRODUCTION AND ANNUAL YIELD, 1930-1 TO 1948-9

Crop Year August 1 to July 31	*Area (Acres)*	*Production (Bales of 500 lb. gross)*	*Yield (Pounds per acre)*
1930-1	148,260	48,427	156
1931-2	228,091	98,035	205
1932-3	299,379	160,262	256
1933-4	971,830	471,803	232
1934-5	1,355,416	452,944	180
1935-6	2,223,518	815,471	175
1936-7	2,587,343	934,501	184
1937-8	2,596,190	1,145,174	187
1938-9	2,230,401	1,260,330	185
1939-40	2,647,261	1,417,664	256
1940-1	2,742,130	1,756,148	306
1941-2	3,222,645	1,303,689	193
1942-3	3,280,252	1,730,002	252
1943-4	3,681,244	2,136,839	277
1944-5	3,789,054	1,073,124	135
1945-6	2,555,840	876,280	164
1946-7	3,137,394	804,932	123
1947-8	2,615,652	686,000	126
1948-9	2,088,000	964,931	222

TABLE 2

Year	*Sao Paulo*	*Other States*	*Total*
Beginning Jan. 1			
1931	258	107,472	107,730
1936	610,762	470,322	1,081,084
1938	922,966	685,982	1,608,948
Beginning Aug. 1			
1940-1	1,150,441	182,097	1,332,538
1945-6	1,404,030	57,654	1,461,684
1947-8	924,670	124,459	1,049,129

The Norris Report

Nearly 30 years have elapsed since the report of the International Commission and the speech of Mr. Arno Pearse at Rio. It is interesting to compare in detail some of the comments made by Mr. P. K. Norris, Agricultural Economist for the office of Foreign Agricultural Relations at Washington, who made a report in August 1949.

Yields. Referring to the table of acreage and production, Mr. Norris suggests that 'the annual yields seem to follow a pattern or series of high and low years.' In other words, 'yields per acre influence to a considerable degree the area planted to cotton in the following year.' This may be deduced from the figures, but the reduced acreage in recent years is probably due to a variety of causes:

Picking a field of cotton in Brazil. Before being transported to the ginnery it is sorted and packed

(1) The increasing popularity of coffee, which has drawn labour from cotton in the São Paulo area.

(2) Speculation and the soil-wasting methods of cropping. From 1930 onwards there was a natural tendency to plant on new land—that is, land recently cleared of bush and scrub. As time went on this land was overworked and growers tried out old coffee and other land which had been left derelict and subject to wind and water erosion. Little attempt was made to maintain and increase the fertility of the soil; indeed, fertilisers are almost unknown to the Brazilian cotton farmer.

(3) Moreover, as has happened in Africa, the chances of growing a crop which produced cash attracted growers to the detriment of the necessary food crops. Even in 1943 the Government started a campaign of ' grow more food.'

Pests. There has been no diminution in insect pests since 1921. It is estimated that the pests may affect yield by anything from 10 to 50%. The pink bollworm is perhaps not so destructive as it was. All seed is fumigated and in many places plants are destroyed in the field after harvest.

In São Paulo the cotton root borer (*Gasterocercodes brasiliensis*) is the most destructive pest. Burning plants after harvest, keeping the fields clean and rotating crops are all palliatives, but no effective method of control has yet been found.

The cotton leaf caterpillar (*Alabama argillacea*), referred to as the ' cotton worm ' by Mr. Pearse, is also a serious pest. The only form of control is spraying three times a year with calcium arsenate, lead arsenate, or other poison.

Seed. The standing of São Paulo cotton abroad is largely the result of controlled seed and gin supervision by the State.

In São Paulo seed production and distribution is under complete control by the State. The State makes contracts with growers for the varieties suitable to the local soil and climatic conditions; the seed is delivered to receiving centres, where it is tested for germination, cleaned, delinted and bagged. When it is distributed an interesting feature is introduced: the price includes a premium on a hail-insurance policy. In this way all the cotton acreage in São Paulo is covered by hail insurance. In São Paulo two varieties of cotton are being produced by the State authorities at the present time, both American Upland types with a staple $\frac{1}{16}$ either side of 1 in. A third variety (Campinas 817), said to be superior to these, will be available in the near future.

The fact that all the seed is now State controlled has ensured uniformity of type and has enabled São Paulo to compete on equal terms with U.S.A. cotton.

Types. Careful classification is carried out at the ginneries and at the port of shipment. From March to December 1949 81% of the cotton was either type 5 or type 5/6.

The cotton cultivator. Mr. Norris's report emphasises the primitive methods employed. Nearly all cotton growing is done, as in Africa, by the man with a hoe. ' Most of the crop is planted by hand. . . . Usually one man makes a hole, a second man follows and drops the seeds, covering them with his foot. Generally the plants are from 30 to 40 in. apart in the rows and rows are 5 to 7 ft. apart. The number of plants per acre is less than in U.S.A.'

Excess plants are pulled out by hand, and cultivation is usually with the hoe, though one-row horse-drawn cultivators are beginning to come into use. It does not follow that the personal attention of the small cultivator does not produce at least as good a yield as crops produced by some form of mechanisation, but, naturally, primitive methods must restrict the acreage. An improvement in this direction can only be gradual. In a recent report of the Joint Brazil-U.S.A. Technical Commission, set up in 1948 by the Brazilian Government under the chairmanship of Mr. John Abbink (Chairman of the McGraw International Corporation of New York), it was stated that only 23% of the farms of Brazil possess any agricultural machinery, while, according to a census of 1940, in the whole country of 3,300,000 square miles there were then only 3,500 tractors in use.

Labour

In Brazil labour is an uncertain quantity. It has been estimated that, out of the total population of 48,000,000, 30,000,000 are employed in agriculture. It has also been estimated that at the peak of cotton production 400,000 persons were employed on cotton. This has now dropped to about 200,000, because coffee is again a popular crop. Many of the small, struggling cotton cultivators, although in general they are said to be improvident, can do better by working on coffee fazenda until they can make sufficient to start again on their own. Then there is the call of the towns and cities, where wages may be four or five times as high as in the country (though, of course, the cost of living is equally high), and as industrialisation increases the movement from the country to the town will also increase.

From the cotton point of view, for the next few years there seems little chance of drawing any labour away from coffee. World consumption has exceeded world production and there can be no falling off in the demand for Brazilian coffee.

Land and fertility

Much land in Brazil within a few hundred miles of the coast has been worked out and deserted. The centre of production is moving from the northern states to São Paulo. Even coffee is moving from the states of Espirito Santo and Rio to São Paulo. But it is not stopping there; both cotton and coffee are stretching out farther south into Parana, always seeking new, fertile land. But Brazil can no longer afford the traditional attitude that there will always be unlimited new land ' beyond the frontier. . . . Brazil has never possessed large areas of level fertile, easily subjugated agricultural lands such as the pampas of the Argentine or the steppes of the Ukraine or the mid-west plains of

U.S.A. The cultivated lands now in production are Brazil's real, proven agricultural wealth ' (Abbink report). Though further lands might be brought in or large irrigation projects started (*e.g.* in the San Francisco river basin), it is not realistic to expect much increase in the present acreage of land for crops. Therefore what is now necessary is the maintenance and restoration of soil fertility.

In the centre region, in the states of Rio, southern Minas, São Paulo and northern Parana—which constitute two-thirds of the crop lands now under cultivation—soil fertility has declined sharply from its virgin state. Soil erosion, less advanced methods of cultivation, depletion of fertility through widespread coffee and cotton planting, lack of soil-building crops and a very limited use of commercial fertilisers have taken a very heavy toll of Brazilian agriculture.

It is interesting to find the candid remarks and criticism of an International Commission in 1921 balanced by similar criticisms by a Brazil-U.S.A. Commission about agricultural organisation in general in 1948. The last two pages are devoted to the organisation of the Ministry of Agriculture. At this stage the U.S.A. delegates, with great delicacy, stood back and allowed the Brazilian members to give their views. This they did with damning clarity. They presented a picture of an administrative bureaucracy without sufficient funds, without sufficient technicians and with little (or too much) organisation: ' The technical departments are subordinated to administrative departments with pitiful results. . . . These administrative departments have a delaying action. . . . The ever-increasing and overwhelming Brazilian bureaucracy causes more damage than erosion itself. And both of these are undermining our national wealth. . . . Freedom of action within practical limits and a true responsibility would defend public interests in a much better way than our network of bureaucratic prohibition,' and so on.

The summary makes suggestions for a new organisation especially to deal with the expenditure proposed by the Salte Plan, a five-year plan issued by the Brazilian Government in 1948 to deal with and improve the vital services of health, food, transport and power at a total cost of nearly 20,000,000 cruzieros, or about £259,000,000 at predevaluation rate, but ends as follows: ' We want to emphasise, however, that no plan will ever be carried out if the present administrative provisions are not modified.'

It is abundantly clear that the Brazilian Government have great problems to face in the future, including the reorganisation of some of their departments, but, from their action in the past two years, they have shown that they are not unaware of their difficulties. They have been broad-minded in again inviting the help of experts from another country.

Outlook and conclusion

What is the future for Brazilian cotton? Here we have a picture of a huge country with varying climates and, in São Paulo and Parana at any rate, with ample rainfall and with conditions for cotton production equal to any rain-grown area in U.S.A.: a country with land not necessarily unlimited, but if reclaimed and properly farmed capable of increased production: a country where, with increasing population, domestic demand should continue to take care of at least 50% of any crop produced: a country where federal and state governments are doing all they can to improve the agriculture of the country, are intent on increasing production and export, and are ready to assist the growers by every means available. With all this the prospects would appear favourable, subject always to the costs of production enabling Brazil to meet competition overseas and subject to the continuance of a stable labour supply.

(Photos: Brazilian Government Trade Bureau, London)

NEW BOOKS

The Propagation of Plants

By E. J. King. Pp. 264. Illustrated. Hutchinson's Scientific and Technical, London, 1950, 16s.

The author offers his book as a working manual both for amateurs and students and sets out to cover a very wide field, dividing it into two parts, namely, propagation by seed and vegetative propagation. Under the first he deals with seed-sowing in the open and under glass, including a useful chapter on home-saved seed, which contains some simple explanations of the mechanism of inheritance and gives six lists, with individual notes, of annuals, biennials, perennials, rock plants and vegetables. Under vegetative propagation he includes nearly all the usual methods of striking cuttings, stem, root and leaf and allows three chapters for grafting. There are also chapters on bud sports and graft hybrids, tree training, degeneration, and the propagation of ferns. A very useful feature is the section headed ' vegetative propagation at a glance,' which contains lists of herbaceous perennials and alpines, hardy bushes, trees and climbers, greenhouse and half-hardy plants, with a suggested method of propagation for each.

Mr. King presents his massed information in a pleasantly readable form. His excellent plan of having numbered paragraphs, whilst materially aiding reference within the book, does not interfere unduly with an easy narrative. He concludes with a useful glossary and a carefully constructed index. The 35 illustrations, all clear line drawings, whet one's appetite for more; they and their legends are, in fact, the most useful feature of the book.

There are blemishes. Thus, stratification of seed, an important, and in some cases an essential, process, is briefly dismissed as heaping all the seeds together and covering them with moist sand for ' about a year.' The walnut we are enjoined to bud in August, but it is very doubtful if anyone has ever really made a success of this in Britain. ' Marsh Spot ' of peas is stated to be a seed-borne disease, whereas it is a symptom associated with a deficiency of manganese, and we have yet to hear of ' strawberry mosaic ' elsewhere though ' yellow edge ' and ' crinkle,' not mentioned, are all too familiar to the grower.

Student interest

A great deal of effort has gone into this book and the author has consistently related principles to practise and is therefore justified in hoping that botanical students and others will find it a convenient introduction to gardening. It is certainly designed for convenience, as well as for pleasure, and the encouragement given to beginners to try propagation at home is most laudable. So much so that any strictures placed upon it probably appear hypercritical. Mr. King, as a keen amateur gardener and a teacher, wrote to meet his own needs, and we imagine he has succeeded, but we would venture to suggest that his own needs are, as the result of years of contact with plants and their environment, much smaller than the basic needs of the real beginner, and the latter he does not quite satisfy.

Moreover, if the students of his book are to pursue their studies further they will want to know what books to study. A list of such references should certainly be included in future editions.

R. J. GARNER.

Two Annual Reports

Annual Report of the Long Ashton Agricultural and Horticultural Research Station, 1949. Pp. 174. Illustrated. 1950, 12s.

Of all the publications of agricultural science, none are more neglected than the annual reports from our research stations. To some extent this is due to lack of publicity; as publishers and reporters of their own work, the research centres have long been much too modest. Nevertheless, those who do manage to obtain copies for their personal libraries know only too well how invaluable they are. The Annual Reports of the Long Ashton Agricultural and Horticultural Research Station have been immaculately published for many years. Unlike the majority of research station reports, the Long Ashton publication follows a policy of providing individual papers by members of the staff, rather than condensed departmental surveys. It is, therefore, a first-class research journal with direct reference value. A considerable expansion in the work and staff of this Station has taken place since the war, and in the recently-issued 1949 Report there is abundant evidence of this modern growth. Today Long Ashton is a spearhead column in the advance of world research on plant nutrition with particular reference to trace elements, on the control of fruit diseases and fruit pests and the study of appliances for spray or dust applications, and on cider and other fruit product manufacture.

Papers in the 1949 Report deal with iron and molybdenum as nutrients for vegetable crops, with newly discovered zinc and copper deficiencies of fruit trees in Britain and with attempts (so far somewhat disappointing in effectiveness) to feed fruit-trees by sub-soil injection with nutrients. Dr. R. S. Willison, a Canadian specialist on virus diseases of fruit, who spent a year at Long Ashton, reports that these diseases are far more prevalent in our orchards than has previously been supposed. Joint work by Long Ashton and Reading University describes new fungicidal efforts to control brown rot, one of the most resistant ailments of hard and soft fruit. Another paper explores the use of modern systemic insecticides to control the green apple aphis. As always in Long Ashton Reports Dr. H. G. H. Kearns combines his unique knowledge of both entomology and engineering to produce further advances in application methods. Nor is the original reason for Long Ashton's creation—the scientific study of cider fruit and cider-making—neglected. Among the papers on this subject, three contain the name of Professor B. T. P. Barker among their authors. Though he retired a few years ago from the position of Director of the Station, Professor Barker continues to work at Long Ashton as a member of the cider research department, a most notable example of continuity of personal effort, for Professor Barker was not only the first Director of the Station, but he was also the first research worker ever appointed to its staff.

D. P. Hopkins.

East Malling Research Station Annual Report, 1949. Pp. 187. Illustrated. 1950, 10s.

The East Malling Research Station is situated in the centre of perhaps the most important fruit-growing area in Great Britain, but it serves as a centre of research for the whole country. There must be few orchards that possess no fruit stock from the Station, and few commercial growers who do not take advantage of its advisory service. The large number of visitors to East Malling is evidence of the continued appreciation of advice given at this centre. The foundation of this advisory service lies in the successful programme of scientific research extending over a period of 37 years. The latest Annual Report, covering the first nine months of 1949, published by the Kent Incorporated Society for Promoting Experiments in Horticulture, shows how extensive is the field of research and how thoroughly it is covered by the staff at the Station. This volume is recommended to fruit-growers, for it is less a report than a valuable book of reference.

The volume is divided into four sections. Details of the working of the experimental farm are contained in section one, in which attention is drawn to the problem of providing sufficient suitable land for an ever-expanding programme of field experiments. Information on research projects in hand and their progress is given in section two. The third section consists of a report of the Amos Memorial Lecture on ' The Soil and the Fruit Tree,' and 22 papers covering a wide range of subjects and describing the results of recent experiments. Section four consists of eight Bulletins for Fruit-growers, written in less technical language.

East Malling has become justly famous for the excellence of new and improved varieties of fruits bred at the Station, and, during the year, further valuable additions are made to this already long list. Tydeman's late orange, a seedling apple from a cross between Laxton's superb and Cox's orange pippin, is being distributed for general cultivation. The fruit is of high quality, stores well and matures at the end of February. Two new raspberry varieties, named Malling jewel and Malling exploit, have been sent from the Station for preliminary trial. The former, when grown in Devonshire, gave a crop equivalent to ten tons per acre, about double the heaviest yield of any variety ever recorded at East Malling. The latter variety seem likely to be adaptable to a fairly wide range of environments. A new variety of black currant, the Amos black, which has the valuable characteristic of very late ripening, was distributed in the autumn of 1949. Increased interest in peach culture out of doors has made the provision of more varieties a matter of importance, and material is therefore being collected for selection purposes.

While the production of new varieties may be spectacular and also desirable, the value of the Station depends equally on the services it is able to render by investigations in other directions. The management of orchards is the subject of many investigations; in this connection, the Amos Memorial Lecture on the soil and the fruit tree is timely. Research reports deal with anti-frost measures, comparative performance of frameworked and topworked apple trees, the control of biennial bearing, and investigation on cover crops.

It is stated that work on plant physiology and pathology is handicapped by the grave lack of information concerning the chemical composition of the plant. In this respect, plant biochemistry lags nearly half a century behind animal biochemistry. Examples in support of this contention are given, and it is added that systematic investigations to improve knowledge in this direction have been initiated.

Much attention is given to investigations on pests and diseases, and on methods of control. In recent years a number of new and very important insecticides have been discovered which may well replace the old methods of pest control. The great potency of these insecticides is most disturbing, for one fears that by destroying beneficial as well as harmful insects the balance of nature may be upset. It is, therefore, reassuring to read that experiments are in hand to study the effects of various insecticides upon beneficial and pollinating insects associated with fruit.

Kent is the centre of an important hop-growing industry. Naturally, therefore, the Station attaches considerable importance to investigations on this crop. Commercial varieties are studied, a large number of new varieties are under test, cultural trials have been continued over a number of years, and investigations undertaken on diseases and pests.

D. H. Grist.

The World Problem of Erosion

Conservation Legislation

Sir HAROLD TEMPANY

THERE is widespread appreciation of the dangers of erosion and of the need for vigorous action to prevent its further extension. There is also increasing knowledge of the practical aspects of soil conservation, and many governments have initiated conservation measures on a considerable scale.

The concept that it is a duty of governments to enforce conservation measures is a radical departure from the view that land ownership confers upon the proprietor the right to use or abuse the land as he pleases, and the fact that legislation to this end has been enacted in many countries and is contemplated in others, shows the extent to which public opinion has been awakened to the need for ensuring proper land use.

The necessity for imposing measures to control erosion naturally brings to the fore the question of legislation designed to enable them to be enforced. The following article, which has been abridged with some modifications from a paper presented by the author to the United Nations Conference on the Conservation of Natural Resources in 1949, discusses the considerations involved and outlines the present position.

Basic considerations

(*a*) **Land Use.** Measures for the conservation of the soil are no longer regarded as special precautions which must be observed where erosion risks are imminent and which can be enforced by simple *ad hoc* legislation; it is now clear that they must form a part of the practice of good husbandry and, as they affect every aspect of agriculture, must be integrated into agricultural systems. Consequently, legislation involves a considerable measure of control over the operations of farming.

The forestry aspects are equally important, particularly protective forests and forest reserves, and the revegetation of lands unsuitable for cultivation.

Moreover, such matters as the siting and construction of roads and railways, the location and planning of towns, villages and buildings and, where mineral resources occur, the conduct of mining operations (particularly open-cast mining and dredging), can all influence the incidence of erosion and must be taken into account, while conservation programmes must be applied to geographical regions as a whole and not piecemeal to individual areas or properties within them.

A legislative conservation programme must take account of all aspects of land usage, and it may be said that in countries where erosion is liable to occur the need for conservation measures acts as a special incentive to the introduction of a policy, the need for which is becoming everywhere increasingly apparent.

Land classification is an essential preliminary; this requires accurate maps and detailed knowledge of the climatic, ecological and pedological conditions. A further requirement is research to determine the factors conducing to erosion and the means of overcoming it. These must be provided even though it may not be practicable to withhold legislative action until full information is available.

(*b*) **Economic aspects.** Economic and social considerations are also important. Wells, Carimo and Myer have pointed out that '. . . a programme for better soil use is likely to be wholly inadequate if its framers are not at least aware of the necessity for integrating soil policy with economic and social policies ordinarily regarded as more or less unrelated to the soil.'

Of primary importance is the density of population. If population pressure is excessive it must be lowered by population movement or absorption into industrial occupations. Correlated to it is the area of land required to maintain an individual and his family at an adequate level of subsistence.

Land tenure is particularly important; if reasonable security of tenure is lacking the incentive to embark on improvements is absent and legislation must fail. It may be necessary in such circumstances to provide legislation prescribing the form of written leases.

Among primitive peoples the position will be influenced by custom and superstition. In many parts of Africa tenure is based upon communal tribal ownership; though this need be no bar to land use regulation, it must be taken into account. Another difficulty is often the small, scattered and fragmented character of the holdings. Maclagan Gorrie has remarked: '. . . an essential for Indian conditions . . . is detailed knowledge of land holding and tenancy practices . . . and the operation of local land revenue settlement procedure. Other essential knowledge is that of consolidation of holdings, for fragmentation is usually a serious stumbling block in any programme for improving cultivation standards. This, with due modification, applies to many other parts of the world.

Other economic factors are methods of marketing, market prices for produce, labour conditions and rates of pay, and the incidence of taxation.

Financial provision is necessary to enable conservation programmes to be carried out and to assist farmers to comply with the requirements of orders which they may be unable to carry out from their own resources. This may involve legislative provision modifying or extending the financial structure of the agricultural industry.

(*c*) **Education and propaganda.** Provision is also essential to disseminate knowledge of the effects of erosion and the steps to counteract it and to conserve fertility. Conservation programmes can only succeed if there is widespread appreciation of the need for them and willingness to support the enforcement of the measures they involve. The effects of erosion may be so spectacular that there is a predisposing willingness to accept measures to arrest it, but their form and the implications involved must be widely appreciated before legislation can be undertaken with the assurance that it will command popular support.

(*d*) **Penalties and sanctions.** Penalties and sanctions must also be provided, for, although programmes of conservation and land use depend in the main on popular support, without them it is impossible to deal effectively with a recalcitrant minority. They must provide, *inter alia*, for (*a*) the right of entry into lands by authorised agents for purposes of survey, inspection

and supervision, (*b*) safeguarding protective measures on state land and (*c*) enforcement of orders in regard to privately-owned lands.

(*e*) **Administrative machinery.** The administrative machinery required to deal with so complex a matter is obviously highly important; probably no detailed prescription applicable to all conditions is possible, but some general principles are evident. Obviously there must be close control over every aspect of land use; there must also be close co-ordination between the official agencies concerned and adequate representation of land users on the controlling bodies.

A number of countries have established special sections of the administration to deal with conservation questions; the outstanding example is the Soil Conservation Service of the Department of Agriculture in the United States of America; other instances are certain states of the Australian Commonwealth, the Union of South Africa, and Kenya.

Alternative procedures may, however, be practicable and in a recent Bulletin of the Food and Agricultural Organisation of the United Nations the opinion has been expressed that 'a soil conservation programme could be attained without organising a separate agency, if the various major disciplines in agriculture include proper attention to conservation in whatever field.'

A primary difficulty is often the large number of official agencies concerned with land use; and co-ordinated control of their functions is essential. Indeed, co-ordinated control at all levels is vital, including a territory as a whole, the administrative units in which it is divided and special sub-divisions which it may be necessary to establish for conservation purposes. The boundaries of the latter should be decided by geographical rather than political considerations, the natural unit being the catchments or watersheds of rivers and streams; but this in itself may be a source of difficulty, since often natural and political boundaries do not coincide.

Experience favours setting up councils and committees at various levels on which official agencies as well as land users are represented.

The form of legislation

Obviously it may be difficult to cover every aspect in a single act of legislation. The most effective procedure seems to be to enact overall legislation covering the major aspects of conservation and land use, and to provide within it ample powers to make regulations which enable appropriate measures to be applied locally under the varying conditions likely to be encountered. The economic and social aspects may require separate legislation.

A necessary preliminary is research and surveys to provide the technical basis for legislation, accompanied by education and propaganda to prepare public opinion to accept it.

Thereafter the successive stages are:

(i) The formulation of a programme.
(ii) Its enactment into law.
(iii) The enforcement and administration of the statute.
(iv) The interpretation and application of the statute in disputed cases by the courts.

It is a process of trial and error and not unusually the original legislation has to be revised and re-enacted to correct defects revealed by experience.

Early legislation

Early legislation naturally tended to concern itself with particular aspects of land utilisation and the first of these was that of forestry. The forestry laws of many countries enacted during the latter part of the 19th and the early years of the present century, insofar as they provided for the creation of protective forest reserves, are the earliest examples of conservation legislation.

An outstanding early example of general legislation for the regulation of land use was the Agrarian Law of 1874 of Indonesia (then the Netherlands East Indies) in which the obligation was laid upon land users to maintain the soil in a fertile condition. Other noteworthy early legislation was the Japanese Forestry Act of 1897, which provided for the establishment of forests to prevent denudation, and the Punjab (India) Land Preservation Act of 1900, which provided for the demarcation of lands requiring protection and the regulation within them of practices conducive to denudation.

Between 1920 and 1934 increasing awareness of the dangers of erosion led to the enactment of legislation in various countries, notably in Canada, parts of Australia, Italy, Palestine and Malaya. However, it was the passing in 1935 of the United States of America Federal Soil Conservation Act and the subsequent State Soil Conservation District Laws which gave the major impetus to conservation legislation throughout the world and provided a legislative pattern which has since been widely followed.

In its combined federal and state aspects it embodies certain general principles; they are:

(*a*) The establishment of an overall authority in the person of the Secretary for Agriculture and the provision of a national soil conservation service.

(*b*) Provision of powers to enforce conservation by acts passed by individual state legislatures, providing (i) for setting up state authorities with general supervisory and administrative duties, and (ii) for the establishment, with the consent of land users, of soil conservation districts administered by Boards of Supervisors.

(*c*) Provision of finance through both federal and state agencies for carrying out conservation measures on both public and private lands.

(*d*) The observance throughout of democratic principles to ensure that the measures are instituted and operated with the agreement of the majority of the land-using sections of the population.

Soil conservation districts

The most important concept is the Soil Conservation district, which enables compulsory control of land-use to be introduced in an ordered sequence over defined areas: the principle that prior to the establishment of a district the consent of the majority of the land users must be obtained, ensures that control will be applied with maximum popular support and minimum opposition and friction.

The district is a local government unit in which farmers can co-operate with technical and other agents of the Government in improvement, both of the lands of the district as a whole and on individual properties.

The boundaries of a district follow so far as is practicable the natural lines of demarcation which are usually the watersheds or catchments of streams or rivers; in some cases, however, particularly in semi-arid areas, other boundaries may have to be sought, while physical or administrative factors may sometimes preclude the natural boundaries being followed completely.

In the United States all 48 states have now enacted district conservation laws and over 2,000 soil conservation districts have been set up.

The legislation follows generally the lines of the model law prepared by the Federal Government although the details vary somewhat in different cases. The general procedure in establishing conservation districts is briefly as follows:

(1) The enactment of state legislation.
(2) The appointment of a state conservation board usually comprised of the heads of technical departments concerned with land use, charged with co-ordinating and supervisory duties and

the definition of the boundaries of conservation districts.

(3) The presentation of a petition to the State Board for the formation of a district, followed by definition of its boundaries by the Board after a public enquiry, and a referendum among land holders. If the vote is favourable the district is established.

(4) The appointment of a board of supervisors for the district, the majority of whom are elected by land users.

(5) The formulation of a programme for the district by the supervisors, its acceptance by the state board and its implementation. Implementation follows two main lines:

(*a*) The establishment and administration of conservation projects.

(*b*) The prescription and enforcement of land use regulations which must first be submitted to a local referendum.

Recent developments

Since 1935 laws embodying some or all of the principles contained in the United States legislation have been enacted in a large number of countries, including Canada, the various States of the Australian Commonwealth, the Union of South Africa, New Zealand, Southern Rhodesia, Ceylon, Kenya, Nyasaland, Northern Rhodesia, Mexico, and some other Latin-American countries.

Summary and conclusions

It is obvious that it is impossible to frame effective legislation without taking into account all aspects of land use. For this reason the movement towards the control of erosion can be regarded as part of the more general movement towards land use regulations which is taking place the world over. In countries in which erosion is an urgent danger, circumstances have accelerated the tendency, but it is really part of the conviction that in view of the rapidly-increasing world populations, the maintenance and enhancement of the fertility of the soil is a duty which devolves on all governments.

There is wide agreement as to the requirements which legislation must fulfil. It is everywhere accepted that adequate provision of technical services for conservation measures is essential. It is also widely agreed that conservation must be organised on the basis of districts or areas, but practice varies in regard to their establishment and operation.

No doubt local conditions affect the issue, but in the absence of factors of overriding urgency, it seems likely that in the long run there may be advantages in leaving the initiative to land users and devolving a large measure of detailed local executive action on to committees with a considerable amount of popular representation.

It is widely accepted that a large measure of popular assent is needed before legislation can be successfully introduced and that to secure this there must be extensive preparation through educative and propaganda measures. It is also generally agreed that there must be ample provision for research and surveys to provide basic data, and for finance to enable programmes to be implemented, while penalties and sanctions for non-compliance must exist, although they should only be used when other means have failed.

It seems likely that there is as yet somewhat less appreciation of the economic implications of conservation programmes, but such factors must in due time make themselves apparent when provision to deal with them may be expected to follow.

As the type of control will vary with the type of agriculture practised, the nature of the country and the economic, social and racial characters of the cultivators, legislation must be so framed as to be applicable to the whole range of conditions likely to be encountered, and there is general acceptance that on this account wide powers for making rules must be included in it.

The case of primitive communities requires special consideration. In many territories, especially in Africa, erosion on lands occupied by native tribes is a matter of supreme urgency. The large number and scattered nature of the holdings as well as the low standard of education of the people makes the solution particularly difficult, while it is often impossible to delay action intil a move comes from the people themselves. Arbitrary powers may be needed at times but experience shows that often the best approach is through the native tribal authorities and local tribal regulations may be the most appropriate first step as a prelude to the ultimate enactment of over-all general legislation.

Inter-territorial and international collaboration is an urgent requirement, especially in continental areas. The natural boundaries for conservation projects are usually the limits of watersheds or catchment areas. Frequently, however, the political or administrative boundaries do not coincide with them and this may hinder the establishment of conservation areas; programmes of conservation may be frustrated by the absence of corresponding provision in an adjoining area under a different administration.

The need for such collaboration has been recognised, for example, in the United States of America, in connection with the Tennessee Valley Development Project which affects a number of States.

The need is equally apparent in other areas. In Africa it is particularly prominent; in the autumn of 1948 an international conference in the Belgian Congo affirmed that the problems of soil conservation and land utilisation recognised neither political boundaries nor territorial limits. They recommended the establishment of an inter-African office of information on soil conservation and land utilisation, the constitution of an inter-African soils research organisation and the imposition through legislation of measures to ensure the conservation of soil and the proper use of land in all territories, which should be sufficiently flexible to permit its application to the peculiarities of different regions.

REFERENCES

R. Maclagan Gorrie: 'Soil and Water Conservation in the Punjab,' 1946.

O. V. Wells, J. P. Carino and D. S. Myer: 'The Remedies,' 'Soils and Men,' U.S.D.A. Year Book, 1938.

P. M. Glide: 'The Soil and the Law,' loc. cit.

E. H. Clap, E. M. Meunier, G. S. Wehrwein: 'Policies for Public Lands,' loc. cit.

G. S. Wehrwein, C. I. Hendricksen, W. H. Sandeman, P. M. Glide and C. C. Taylor: 'Policies for Private Lands,' loc. cit.

A. W. Joachim: 'Soil Conservation Legislation,' *Tropical Agriculturist*, Vol. 92, 1939.

G. V. Jacks and R. O. Whyte: 'Erosion and Soil Conservation,' Technical Communication, No. 36, Commonwealth Agric. Bureaux, 1938.

G. V. Jacks and R. O. Whyte, 'The Rape of the Earth,' 1939.

'Soil Conservation Districts for Erosion Control,' U.S.D.A. Misc. Publicn., No. 293, 1937.

'The Prairie Farm Rehabilitation Act—a Record of Achievement,' Ottawa, 1943.

Hopkins, Palmer and Chepel: 'Soil Drifting Control in the Prairie Provinces,' Publn. 268, Dominion of Canada Dept. of Agriculture, 1946.

J. M. Holmes: 'Soil Erosion in Australia and New Zealand,' 1946.

K. B. Cumberland: 'Soil Erosion in New Zealand,' 1944.

A. O. Lawrence: 'The Soil Conservation and Land Utilisation Act of Victoria,' *Australian Forester*, XI, 1947.

The Annual Report of the Department of Conservation, New South Wales, for 1947, 1948.

'Farming in South Africa,' Vol. 22, No. 251, 1947.

Ibid, No. 261, 1947.

'Soil Conservation, an International Study,' F.A.O., 1948.

Report of a Commission of the Royal African Society, 1943.

H. A. Tempany: 'Soil Conservation Practice in the Colonial Empire,' Tech. Comm. 45, Commonwealth Agricultural Bureaux, 1949.

H. A. Tempany, G. Roddan and L. Lord: 'Soil Conservation in the Colonial Empire,' *Empire Jnl. of Expmtl. Agriculture*, Vol. 12, 1944.

Resolutions of the 1st African Conference on Soil Conservation, Unpublished, 1948.

H. H. Bennett: 'Our American Land,' U.S.D.A. Misc. Pubn. 596, 1948.

So far as possible the original legislation referred to has also been consulted throughout.

Commonwealth Agricultural Bureaux

Review Conference 1950

The Commonwealth Agricultural Bureaux perform an invaluable service in compiling and disseminating information regarding recent advances in various branches of science in their application to agriculture. They are also an example of successful collaboration between the various member nations of the British Commonwealth in a task of world wide importance. A general account of the Bureaux and their work was published in the August 1950 issue of World Crops.

THE administration of the Bureaux is vested in the Executive Council, which consists of a representative of each participating government in the Commonwealth with one member for the Colonial Empire. The Bureaux are run by this Executive Council for and on behalf of the various Commonwealth governments.

The Skelton Committee in 1933 recommended that the work of such Commonwealth organisations as this Executive Council and its Bureaux should be reviewed periodically. The first British Commonwealth Review Conference was held in 1936 but the 1939-45 War prevented any further meetings until 1946, although the Hankey Report on the Bureaux was published in 1943.

The third Commonwealth Agricultural Bureaux Review Conference was held in June and July 1950 at Church House, Westminster, London, when delegations from all the participating countries met to review the work of the Institutes and Bureaux since 1946 and to make financial provision for the years 1952-57.

The Conference was formally opened on Wednesday, June 21, by the Rt. Hon. Tom Williams, M.P., Minister of Agriculture and Fisheries in England and Wales, on behalf of the United Kingdom Government. This first session of the Conference was attended by some 50 delegates from the United Kingdom, Dominions, Colonies and Ireland, as well as the directors and consultant directors, of the Institutes and Bureaux, and many officials from the organisations interested in the work of the Commonwealth Agricultural Bureaux.

The Chairman of the Commonwealth Scientific and Industrial Research Organisation and leader of the Australian delegation, Dr. I. Clunies Ross, was elected Chairman of the Conference. The leaders of the other delegations were Sir Patrick Laird, C.B. (U.K. and Chairman of the Executive Council), Dr. E. S. Archibald, C.B.E. (Canada), Mr. F. R. Callaghan (N.Z.), Mr. R. McClery (S. Rhodesia), Dr. J. S. Marais (South Africa), Mr. C. G. Eastwood, C.M.G. (Colonies), Dr. A. M. Shaikh (Pakistan), Mr. R. C. Maxwell Darling (Anglo-Egyptian Sudan) and Mr. J. Mahony (Ireland).

Section committees

In order to expedite the business of surveying the work and plans of the organisation, five committees were set up, each charged with reviewing a section of the Bureaux' activities and submitting recommendations to the conference on such matters as publications, finance and administration. During the first week all delegates visited the two institutes which are conveniently placed at South Kensington and Kew, after which two parties were formed which toured Great Britain to visit the various Bureaux.

On their return to London the delegates devoted the last week of the Conference to the preparation of the various Committees' reports for submission to the plenary sessions at which over 80 recommendations were finally adopted. These recommendations have to be approved by the constituent countries before they can become operative in the 1952-57 quinquennium.

New Bureau recommended

One particular recommendation was the establishment of a new Commonwealth Bureau of Agricultural Economics which might be attached to the Institute devoted to that subject at Oxford. Other possible Bureaux were considered but none was recommended for the 1952-57 period. Other points worth noting are the recommendations that the Commonwealth Bureau of Biological Control should remain in Ottawa, Canada, and that the offer of the United Kingdom Agricultural Research Council should be accepted to take over and maintain the Commonwealth Potato Collection.

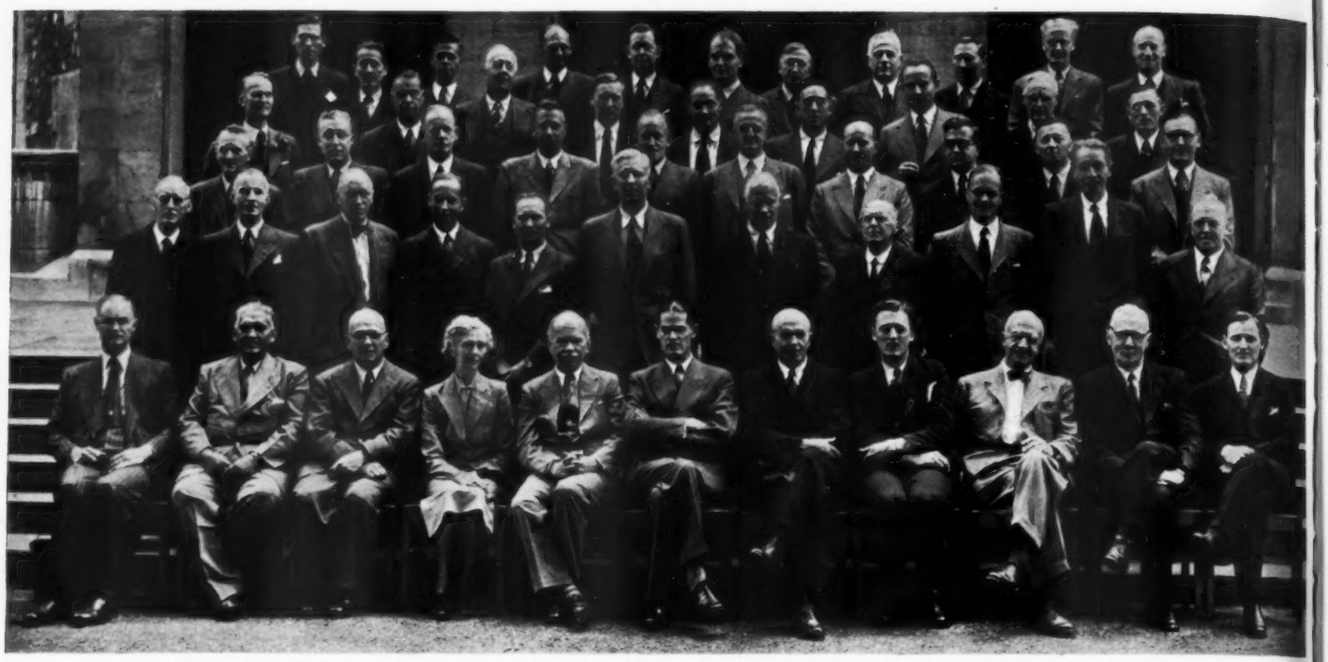
Increased liaison

Particular stress was laid in several recommendations that there should be closer liaison between the liaison officers, official correspondents and the directors of Institutes and Bureaux, and in this connection it was considered that provision should be made for directors to visit Commonwealth countries more frequently. Similarly, arrangements for overseas staff from the Commonwealth to be attached to Bureaux for study or abstracting duties were considered desirable. The decision to increase co-operation between the Bureaux and international bodies was recommended and it was felt that a scheme should be devised for the association of extra-Commonwealth Governments with the organisation as contributors.

Hospitality to delegates

The delegates were entertained by many bodies during their stay in the United Kingdom. They and their wives were honoured by being the guests of Their Majesties The King and Queen at the Royal Garden Party at Buckingham Palace on Thursday, July 13. On Wednesday, July 5, they were the guests of the Royal Agricultural Society at the Royal Show, Oxford, and in Scotland the civic authorities in the cities of Edinburgh and Aberdeen each gave a luncheon in their honour. The farewell party was given on July 14 at Hampton Court Palace, when the United Kingdom Government entertained the delegates to a dinner given in William III's Orangery, at which Lord Ogmore, Under-Secretary of State for Commonwealth Relations, presided. Amongst the guests present were the High Commissioners for New Zealand and Southern Rhodesia, the Earl of Huntingdon, Sir Ben Lockspeiser and Sir Donald Vandepeer.

The many recommendations and the budget for the quinquennium 1952-57 have now to be submitted to the member governments for their consideration. In 1955 the next Conference will be held to review progress during this 1952-57 period and to decide upon financial provisions during a further five-year period.



Members of the third Commonwealth Agricultural Bureaux Review Conference, held in London, June-July, 1950. They recommended the establishment of an Agricultural Economics Bureau

CORRESPONDENCE

African Peoples and Agriculture

TO THE EDITOR,

Dear Sir,

During his recent review of Colonial policy in the House of Commons Mr. James Griffiths stated that a deal of thought was now being given to the possibilities of group development in peasant agriculture. Nothing so far has been said concerning the educated and progressive Africans who qualify in Agriculture, except to hint at possible vacancies in the lower paid posts of the executive services. If Africans are to take degrees in agriculture they need helping towards an appropriate level of prosperity. Meanwhile, criticism has been levelled at an educational system which gains only 62 Colonial Students to study agriculture in the United Kingdom out of a total of 3,973, in spite of the fact that their countries overseas depend for their future progress and welfare on agricultural development.

The schemes for group farming and settlement so far instituted in Kenya concern the allocation of little more than half a dozen acres per individual, and though these plots may be sufficient for the peasantry if they are farmed in accordance with the rotations laid down, it is proving difficult to entice sufficient Africans to take up these holdings, doubtless because of the conservatism of the womenfolk and the fact that the peasant woman is still the cultivator throughout the land.

The educated African will not be encouraged to take up agriculture as a career unless there is more than a hint of vacancies in the agricultural executive and, perhaps, research services. Why not, therefore, give him a chance to farm along modern lines commensurate with his qualifications? In other words, why not encourage him to become a farmer-settler in his own country? If an African is capable of qualifying as a doctor, he is surely capable of becoming a qualified farmer, and equalling the efforts of immigrant farmers today.

The snag is that the African seldom has sufficient capital with which to start a farm of, say, a hundred acres or more. But, surely, he could be subsidised? Surely the clearing of land, the provision of water supplies, housing, implements and so forth, for the purpose of settling qualified Africans on farms would, in not too long a time, be a better proposition financially than the groundnut scheme at Kongwa? Here is a great slice of land already cleared, with implements awaiting use, land which would surely give better returns under small holdings and mixed farming, and give an opportunity to create satisfaction among the African people; to win them, in fact, away from their growing mistrust of European aims. At the same time, the African male would be lured towards the cultivation of his own land by becoming the proud possessor of mechanical implements which would need his skill to be used. His womenfolk, his children and his illiterate relations would provide the 'hands' on the farm, so that the acreage allotted under leasehold to such an individual would, in fact, absorb as many of the population as would the allocation of small plots per peasant farmer, and thus relieve the pressure in the tribal areas.

Rules of land tenure would have to be strict, with an eye to the betterment of the soil and the repayment of capital loan expenditure. The latter could be arranged for either by a reasonable rental to begin when the farms had been established, or by the delivery of produce wanted for export. Any land allocated for the settlement of Africans should be leasehold, so that rights of tenure are held by reason of the rules with which the tenant must comply. African local governments throughout Uganda are now being asked to draw up by-laws governing land tenure in accordance with tribal customs, and it is hoped that this opportunity for including rules for the proper use of the land will not be missed.

Yours faithfully,

A. E. HAARER.

Crawley Down,
Sussex.

FARM MACHINERY

THE SMITHFIELD SHOW

The Smithfield Show, which now incorporates one of the largest agricultural machinery displays in the world, will be held at Earls Court between December 4 and 8. Below are accounts of some of the machines which are expected to be on show at the exhibition.

Part of the Fordson range. *Top*—**The 'Major' with full tracks;** *Centre*—**Ridger attachment on the 3-point linkage ;** *Bottom*—**' Major ' with half-tracks**

Spraying Machines for the Farmer

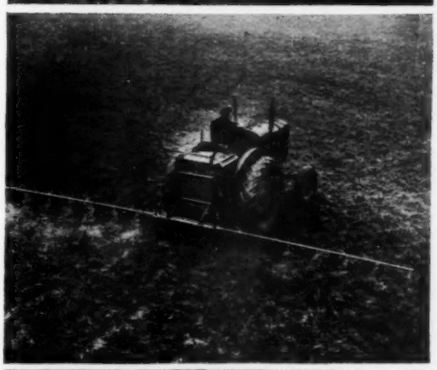
Five machines from Pest Control Ltd.'s range of spraying machines are to be exhibited at the Smithfield Show.

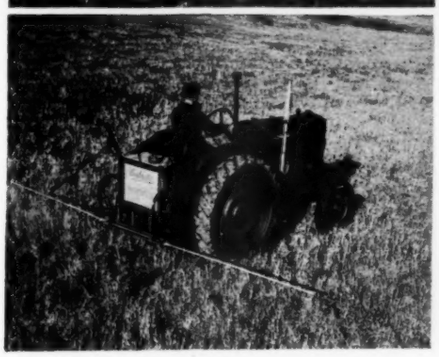
Our photographs (right) show three of them; the 100-gallon Universal (top), the Super Weedmaster, and the Weedmaster, model 2 (bottom). The other two models to be shown are the Hertford 300-gallon sprayer, and the 200-gallon Universal Major.

The 100-gallon Universal model is a trailer-type spraying machine which can be used with all types of wheeled tractors. The two-piston reciprocating pump can be driven either from the tractor power take-off, or from a petrol engine; overall width of the spray bar is 24 ft. and the machine can be supplied with attachments for crop spraying, orchard and hop spraying.

The Super Weedmaster is a tractor-mounted, low volume sprayer, convertible for high volume applications. The pump has an output of 30 gal./min. at 60lb./sq. in. The spray bar is made in three sections with a total width of 25 ft.

The Weedmaster Model 2 is a low volume machine for mounting on a Fordson Major or Ferguson tractor. The tank has a capacity of 45 gal. as opposed to 60 gal. for the Super Weedmaster. Spray bars are of the 13 eyelet type with teejet nozzles at 18 in. pitch, giving a total swathe width of 19 ft. 6 in.





Heavier Tracklayer Announced

Vivian Loyd and Co. Ltd. announce that they are now producing a new ' Dragon ' crawler tractor, having greater strength and several improvements over the D.P. model. The new model has been undergoing various trials, such as destruction tests, on the War Department's testing ground at Aldershot. It weighs over 3½ tons with heavy tracks fitted.

Some points of interest from the makers' specifications are listed below:

Engine: four-cylinder 40-h.p. Diesel (Nebraska rating) with hand-operated automotive single-plate clutch. Gearbox: four forward speeds and one reverse. Tracks: 12 in. or 14 in. wide trackplates, the former giving a ground pressure of 6 lb./sq.in. Drawbar pull: 7,000 lb. Power take-off: approximately 550 r.p.m.

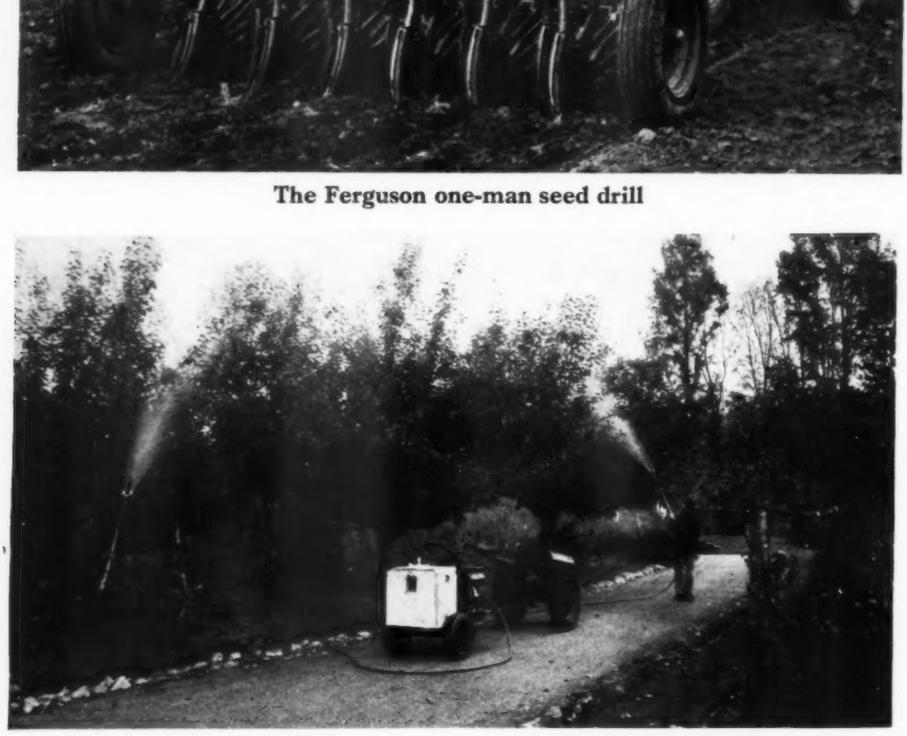
The export sales department of this company now has a new address: it is situated at their factory in Bridge Road, Camberley, Surrey.

Widening the Sprayer Range

Two newcomers to the range of ' Mistifier ' spraying machines, manufactured by Drake and Fletcher Ltd., of Maidstone, are to be exhibited at Earls Court. The first is the L.O. estate sprayer designed for small acreages of fruit and for a variety of other crops where passageways are limited. The standard model for hand draught has a 2½-h.p. engine with a working pressure of up to 300 lb./sq.in. and a capacity of 260 gal./hr. Approximate dimensions are: length, 4 ft. 10 in. with a 35-gal. tank, 5 ft. 9 in. with a 60-gal. tank; height, 3 ft. 4½ in.; and width, 3 ft. Three other models of this sprayer are available, designed for a tractor drawbar, tractor power take-off and garden tractor. The provisional price of the standard model is £135 (35-gal. tank).

The second addition to this firm's range is the ' D.X.' crop sprayer, which, it is claimed, is capable of applying up to 46

The Ferguson one-man seed drill



The L.O. Estate Sprayer, made by Drake and Fletcher Ltd; this is the garden model driven by its own 2½ h.p. Villiers engine

gal./acre travelling at 4 m.p.h. It carries a 220-gal. capacity tank and a 23-ft. wide folding spray boom which is reported to give effective cover over a width of 24 ft. The machine weighs approximately half a ton, is 10 ft. 8 in. long (including drawbar), 7 ft. wide and 5 ft. 4 in. high. A 120-gal. model is also available.

Worm Grain Conveyor

A spiral feed grain conveyor is now being manufactured by Mitchell Colman and Co. having a capacity, it is claimed, of 6 tons an hour. Driven by a three-phase electric motor which develops about 2½ h.p., grain is wormed up the conveyor into sacks, bins or other receptacles. The conveyor is tubular and mounted on a tripod so that it can be swung round and sunk into loose grain at any angle. Called the ' Spirolift,' this conveyor is being sold at £113.

Overseas Buyers' Service

At London's Smithfield Show, to be held at Earls Court, December 4-8, representatives of the British Agricultural Machinery Manufacturers' Exporters' Association (BAMMEX) will be available in the overseas visitors' lounge to give advice to manufacturers and buyers from overseas and in this way save them much time finding the firms in which they would be particularly interested.

The Association played a leading part in the Agricultural Machinery Mission to Canada in 1949 and also at the International Fair held in Toronto last May. Since the beginning of this year trade with Canada has increased by 500%.

The Chairman of the Association, Mr. H. J. Lloyd, O.B.E., is himself on the Managing Committee of the Smithfield Show.

One-Man Seed Drill

One-man seed sowing at a rate of four acres an hour is possible with the new Ferguson 13-row drill, it is claimed. Under 9 ft. in width, it is pneumatic-tyred and of all-steel construction.

It is designed as a one-man unit for quick attachment to the Ferguson hydraulic lift linkage, giving favourable weight distribution to ensure maximum wheel grip and traction. The seeding mechanism is of the force-feed fluted roller type and capable of sowing almost all kinds of seed with uniform accuracy from a maximum of 7 bushels an acre of wheat or barley to as low as 2 lb. an acre of turnip seed. Beans and maize are also delivered with the same facility, for the adjustable feed gate prevents any danger of seed being cracked and also permits instant emptying of the hopper after use. The movement of a lever over a graduated dial makes all adjustments of seeding rates without the necessity of changing gear wheels.

Normally disc coulters are supplied and they may be raised and lowered by hydraulic finger-tip control, which also automatically stops and restarts the flow of seed. The rust-proofed feed tubes are extremely flexible and the waterproof hopper, being only 41 in. above ground level, is especially convenient for filling. Row spacing is fully adjustable from 5 in. upwards. The maximum row width for 13 rows at a time is 7 in., while stop plates inside the hopper permit drilling at any desired row width up to the maximum of four rows at a time 28 in. apart. Even wider spacing is possible with fewer rows. Depth is adjustable from the tractor seat by control handle and rack on the top tractor link to a depth of 3 in. where necessary. Spring pressure on the coulters can be adjusted according to conditions.

The actual delivery of seeds can be clearly seen from the tractor seat. This, and the fact that the drilling is put in and out of gear by the hydraulic lever beside the driver, makes a second operator unnecessary.

The machine, which will be on view at the Smithfield Show, is priced £117 10s., carriage paid, and a marker is available as an accessory.

3 cwt./hr. Conveyor Grass Drier

A small 2-3 cwt./hr. grass drier to be on view at the Smithfield Show is the Kennedy and Kempe drier, available for either coke or oil firing. Wet grass is delivered into a feed hopper and conveyed through the drying chamber by tines; the material

to be dried is carried up the first slope of the drying bed and then falls on to a second slope, partially turning over and loosening itself in the process. The air-flow is so arranged that only about one-third of the air—the fully saturated part—escapes into the atmosphere outside, the remaining two-thirds being redirected through the fan, together with hot air from the furnace; this mixture passes under and through the wet material. The rate at which grass is allowed to pass through the drier is regulated by an eight-speed gearbox and grass with widely differing degrees of moisture can, by means of gear ratios, be successfully dried.

A 7½-8 h.p. engine is needed to drive the fan belt pulley at 750 r.p.m. The drier is roofed and can, therefore, be erected in the open without any additional cover.

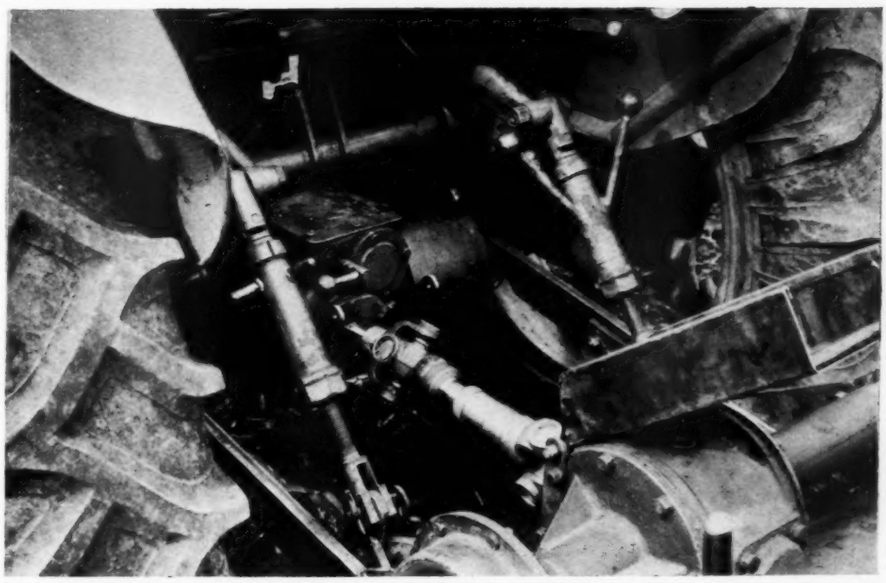
This same firm also manufactures a pneumatic-type grain drier, which has already been described in the August issue of WORLD CROPS.

Rotavators on Show

A new type of linkage and drive for the Howard Rotavator, shown in our photograph, is to be demonstrated at the Smithfield Show. Driven by a Hardy Spicer universal coupling, the Rotavator can be fitted to the tractor without the use of any nuts or bolts; the fixing is entirely by pin in four linkage points. It is designed for the David Brown ' Cropmaster ' tractor.

Other Howard innovations include a new engine for the ' Gem ' Rotavator, which is, briefly, an air-cooled, in-line, twin-cylinder overhead-valve engine, developing about 9½ h.p. at 1,500 r.p.m. The extra power produced will enable a 30-in. wide rotor to be fitted instead of a 20-in. one as hitherto. The 6-h.p. engined machine will continue in production. Rotavator attachments for the Fordson Major, Ferguson and Nuffield Universal tractors will also be shown.

The Howard Rotovator attachment for the Ferguson (50 in. orchard model), cultivating close to trees



New type of linkage and drive employed in the Rotavator attachment for the D.B. Cropmaster tractor

Gas-Turbine Drying

Following the Tiltman-Langley quarter-scale Mark II mobile crop drier, the full-scale Mark III drier is now in production and will form the main exhibit of McCall and Co. at the Smithfield Show. Known as the ' T.L.' mobile crop drier, this machine has four times the capacity of the Mark II model. On four wheels and of light weight, the ' T.L.' drier can be towed to any part of the farm for drying on the spot. As with the Mark II machine, the crop is dried between two drums, one stationary, the other rotating, the crop being carried round by means of tines spring-loaded to prevent possible roping or balling. Hot air passes through the moving material to ensure even drying, a proportion of the saturated air being bled off to atmosphere and the remainder recirculated with the fresh intake to prevent scorching. Temperature is thermostatically maintained and does not exceed 300°F. One man can load and leave the drier to do its work whilst he cuts and collects the next load for drying, thus saving the time and expense incurred in carting wet material from field to static drying plant.

The drums are divided into three bins, loaded in succession and drying can therefore be carried out in one continuous operation; or the drier can be operated on the batch principle, all three bins being loaded and unloaded at the same time.

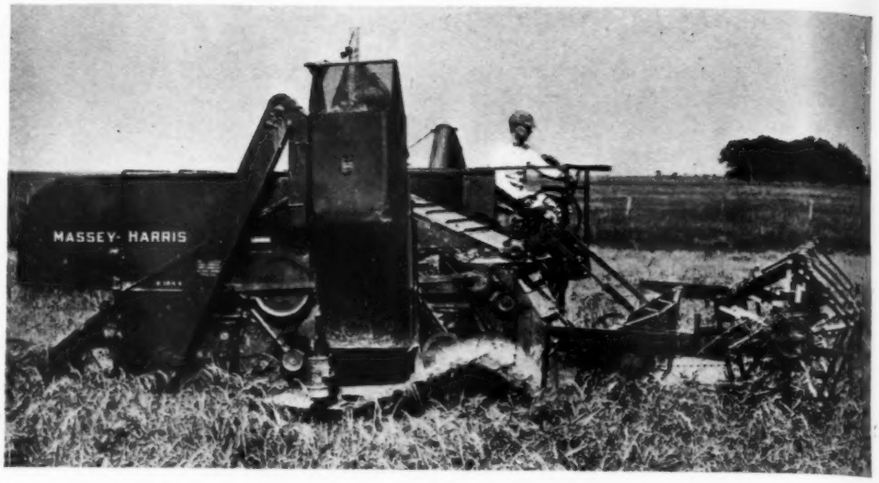
The average capacity of the drier is 3 cwt. of dried material per hour, a figure that can be increased or reduced according to the moisture content of the wet crop. Fuel consumption also varies with the moisture content of the wet material, but an average figure of fuel consumed per ton of dried output is 60 gal. of vaporising oil (kerosene) or gas oil. The fuel tank holds 80 gal., with alternative suction pipes for 40-gal. drums. Power requirement for full capacity is 10 h.p., applied from a tractor pulley take-off, stationary engine or self-contained engine mounted on the drier.

Dimensions of the Mark III drier are: overall length 27 ft., or 23 ft. with towbar stowed; height, 9 ft.; width, 7 ft. 6 in.

A special ' T.L.' oil burner, to be shown

at the Smithfield as a separate unit, has a capacity range of from 890,000-1,500,000 B.Th.U.s per hour. This has been developed from the aircraft gas turbine engine burner and is here applied to crop drying for the first time. Although originally designed as an integral part of the ' T.L.' crop drier, the burner can be separately used for other agricultural and horticultural purposes, such as for tripod hay drying or greenhouse heating.

Another unit of equipment to be exhibited by McCall and Co. is the ' T.L.' grain drier, primarily intended as an attachment to the ' T.L.' crop drier, but also applied as a separate unit complete with oil burner. Hot air is blown through specially designed pokers inserted into the grain sacks; no fixed sack grids being necessary, the drying of the grain can be carried out anywhere most convenient to the farmer. If grain silos or sack grids are already in use, the hot air can be directed equally well into these. Up to 60 sacks at a time can be dried in rows, the sacks being replaced in rotation.



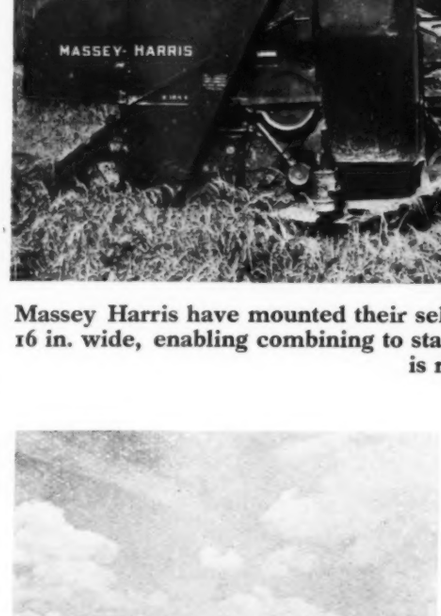
Massey Harris have mounted their self-propelled combine on tank-type tracks 16 in. wide, enabling combining to start after heavy rain the moment the rice is ready

N.D. Agr. E.— A New Diploma

Details have now been released of the 1951 examination for the National Diploma in Agricultural Engineering (N.D.Agr.E.) to be held by the Institution of British Agricultural Engineers.

This development gives recognition to the growing importance of a large and specialised branch of engineering and follows the rapid increase of agricultural mechanisation throughout Britain and the Commonwealth.

Up to the present there has been no provision for training in agricultural engineering other than the post-graduate course at King's College, Newcastle-upon-Tyne, and the syllabus laid down by the Institution of British Agricultural Engineers will provide a common examination standard for technical colleges, agricultural colleges and universities.



The Massey Harris No. 701 pick-up baler—a one-man outfit

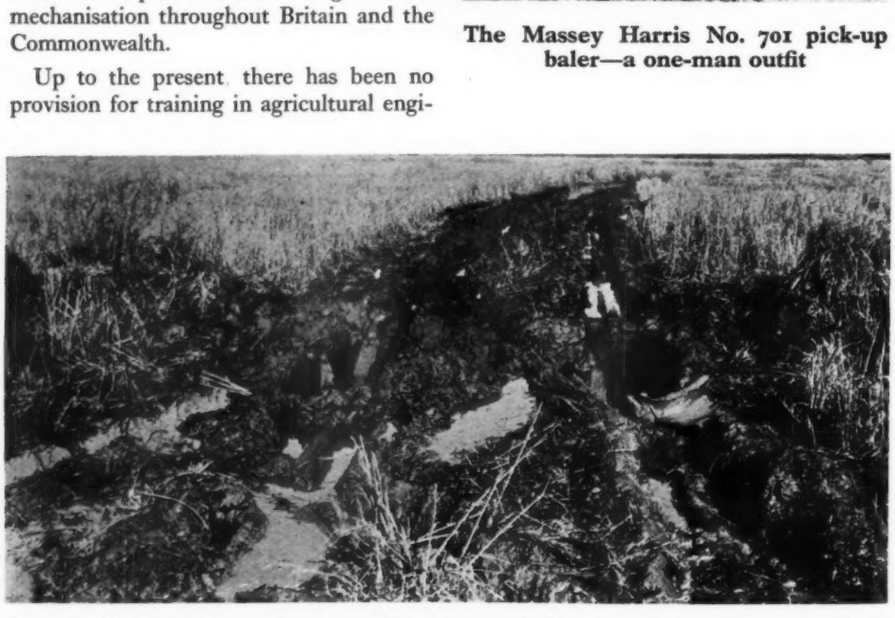
To be eligible for the examination, candidates will need to have completed two years' full-time study or the equivalent period in part-time study, and one year's practical work.

Syllabus

The syllabus for the first year's study and qualifying examination covers engineering subjects, including Technical Mathematics, Physics, Engineering Science and Engineering Drawing. Exemption from this part of the examination will be granted to candidates who hold an ordinary National Certificate in Engineering or who are graduates in engineering or holders of a recognised diploma in engineering. Exemption may also be granted to holders of University Degrees in Agriculture, the National Diploma in Agriculture or other similar qualifications.

The diploma examination covers agricultural engineering, agricultural science or engineering science and a choice of two of the following subjects: field engineering, farm buildings and mechanisation, crop production and mechanisation, and agricultural engineering design.

Forms of application for permission to sit for the examination may be obtained from: The Secretary, The Institution of British Agricultural Engineers, 24 Portland Place, London, W.1, on or after Thursday, March 1, 1951.



A typical condition caused by wheel equipment on wet rice fields, making mechanised harvesting an expensive and laborious business

WORLD CROP REPORTS

England, Wales: corn crops

Estimates of yields of corn from the 1950 harvest in England and Wales are little different from the 10-year average, according to the Ministry of Agriculture. This comparison is, however, affected by the fact that yields per acre have risen appreciably during the last 10 years.

The yield of **wheat** was forecast at 20.3 cwt. per acre, compared with 20.6 cwt. in 1949 and a 10-year average of 19.1 cwt.; quality was fair. **Barley** yielded an estimated average of 17.6 cwt. per acre, compared with 20.6 cwt. last year and a 10-year average of 17.8 cwt. Quantity and condition of the grain were reported to be below average; wet weather caused discoloration in many districts. The average yield of **oats** for the country was (estimated) 16.8 cwt. per acre, compared with 19 cwt. last year and a 10-year average of 16.8 cwt.; quality and condition varied considerably.

Russia increases crop targets

According to a FAO report, some quantitative information on crop production in the Soviet Union is available, but the breakdown into the individual cereal crops is not disclosed. The grain harvest in 1949 totalled 124 million metric tons, and the target for 1950 was set at 127 million metric tons. The official expectation is that this target will be reached, as a larger area was seeded and growing conditions appear to have been favourable. The 1950 target for sugar beets is 20 million metric tons, for raw cotton 3 million metric tons, and for sunflower seed 3 million metric tons.

More Mexican coffee

Mexico's 1950-51 coffee crop, to be harvested from October 1950 to January 1951, is forecast at 1,065,000 bags. This is an increase of 12% over the 1949-50 output of 950,000 bags and only 3% below the record production of 1,100,000 bags in 1948-49. Allowing 300,000 bags for Mexican consumption, the 1950-51 harvest should provide about 765,000 bags of coffee for export.

Fewer Ceylon coconuts

Ceylon's production and exports of copra and coconut oil during the first six months of 1950 were down sharply from the corresponding period of 1949, according to a report in *Foreign Crops and Markets*.

Coconut production during the first half of the year is estimated to have been 20-25% below normal. (About 2 billion nuts a year are produced normally.) The drop is attributed to insufficient and poor distribution of rainfall during 1949 and early 1950. Production during the last half of the year is expected to improve greatly because of recent rains, but the output for the year will probably be below normal.

Lower production and Government controls reduced exports during the January-June period. Copra shipments, practically all to Pakistan, amounted to 1,449 long tons, compared with 11,729 during the corresponding period of 1949. Coconut oil shipments amounted to 22,076 tons, against 42,931 in 1949 (six months). The Netherlands, Pakistan and Canada were the principal markets, taking 9,906, 4,847 and 3,066 tons respectively.

Total exports of copra and coconut oil, copra equivalent, during the first half of 1950 were 36,490 tons, compared with 79,873 tons during January-June 1949.

Stocks as of June 30, 1950, are reported at 21,000 tons of copra and 9,500 of coconut oil, considerably higher than at the end of the first quarter, due to the Government's ban on exports of copra (except for the small volume to Pakistan) and the virtual ban on coconut oil exports due to the high minimum price set by the Controller of Exports, which was above world prices.

High quality Brazil coffee

The total supply of coffee for export from Brazil during the 1950-51 crop year (July 1 to June 30) is estimated at about 19.8 million bags, according to the American Embassy, Rio de Janeiro. This consists of port and visible interior stocks of 5.8 million bags carried over from 1949-50 and an Embassy forecast of 14 million bags for export from the 1950 harvest. If normal port working stocks of 3 million bags are maintained, less than 17 million bags may be available for export during 1950-51. Exports of coffee from Brazil reached a peak of 19.4 million bags in the calendar year 1949.

Trade sources indicate that the quality of the coffee from the 1950 harvest is unusually good. The weather continued dry in July and good progress was made with harvesting. In São Paulo rain was below normal from May to July, but the trees have remained in fairly good condition because of accumulated soil moisture resulting from abundant rain during the first quarter of the year. Good rains fell in southern São Paulo and northern Parana during early August, but the other producing states needed rain.

Australian crops, then and now

The following table, abstracted from the *Quarterly Review of Agricultural Economics*, compares the average yields per acre of various primary products for the years 1934-39 and 1944-49. It will be seen that there has been little increase in average yields among the cereals and, in fact, wheat and barley yields have decreased slightly and rice by over 10%. A substantial increase has been made by tobacco, the average weight per acre of dried leaf having increased by nearly 50%.

Crop	*Unit*	*Average 5 years ended* 1938-39	*Average 5 years ended* 1948-49	*Difference*
Cereals:				
Wheat ..	bus.	11.89	11.72	—
Barley:				
2-row ..	,,	17.26	16.72	—
6-row ..	,,	14.77	14.22	—
Oats ..	,,	10.84	11.86	+
Maize ..	,,	23.60	25.58	+
Sorghum (grain) ..	,,	n.a.	19.69	
Rice ..	,,	99.66	88.84	—
Hay ..	ton	1.13	1.25	+
Other Crops:				
Potatoes ..	,,	2,83	3.66	+
Sugar Cane*	,,	20.67	20.62	—
Tobacco dried leaf)	lb.	498.98	736.06	+
Flax ..	ton	0.06	1.06	+
Cotton(unginned)*	lb.	330.03	328.75	—

* Per acre of productive crops.

Union of S.A. reports

This season's South African maize crop is expected to total nearly 8,000,000 bags more than that of the previous season, according to the seventh and final estimate of the Division of Economics and Markets of the Department of Agriculture. Based on reports received at the end of August, a crop of 28,317,000 bags of 200 lb. each is expected. The kaffircorn crop for the 1949-50 season is estimated at 1,076,000 bags of 200 lb. each, compared with 810,000 bags for the previous season. The groundnut crop on European farms for this season is estimated at 1,842,000 bags of 100 lb. (unshelled), compared with the previous season's crop of 1,377,000 bags. The sunflower seed crop is expected to be 94,000 bags less than that of last season.

Errata

On page 431 of the October issue we described a new hormone type chemical, ' Tuberite,' produced by Plant Protection, Ltd. It was described as being applied in liquid form but is, in fact, applied as a powder.

The new seed dressing, also described on that page, is called ' Fernosan B,' not ' Fertosan ' as printed. The latter is an organic manure which acts as a compost accelerator, manufactured by Fertosan, Ltd., of Wolverhampton.

WORLD CROPS INDEX

VOL. II • 1950

A

Advances in Agronomy (*book review*) . 387
Aerial top-dressing trials . . . 463
Africa
  agricultural conditions in tropical . 370
  agricultural problems of tropical (*ed.*) 232
  ricefield for the Sahara . . . 149
  Royal Show for Rhodesia. . . 399
  two conferences in Nigeria . . 109
African
  land utilisation 267
  peoples and agriculture (*corres.*) . 515
Agricultural
  Co-operative Association meeting . 303
  Economics Bureau, recommended establishment of 514
  education, new college . . . 244
  Research in the French Colonies (*book review*) 168
Agriculture
  in Cyprus (*book review*) . . . 124
  in Fiji 227
  in Soviet Russia (*book review*) . . 77
  in the Belgian Congo (*book review*) . 117
'Alcohol and Agriculture' . . 379
Alcohol
  as a fuel 382
  methods of production of. . . 380
Algae, protein value of (*ed.*) . . 185
Antibiotics
  and fungoid diseases . . . 195
  and Plant Protection *by E. Grossbard* . 194
  definition and description of . . 194
  effect of organic matter on . . 196
  in the soil 197
  toxic actions of 195
Anti-Locust Campaign, Marshall Aid for 497
Ants for biological control (*ed.*) . . 3
Arab Palestine, the Wadi Qilt project . 129
Arable land in Japan 216
Argentina, deciduous fruit in . . 138
Arkotine D.15, new DDT emulsion . 251
Argentinan tobacco crop . . . 275
Aslib (*book review*) 388
Assam, tea cultivation in . . . 280
Australia
  cork production 445
  crop production in 395
  increase in crop acreage . . . 138
  production of dried apples . . 27
  rice growing development . . 498
  rye production in 130
  Snowy River project in . . . 68
  storage dam for 172
  tractor production in . . . 181
  vegetable production in . . . 446
  wheat and rice in 487
Australian
  crops, comparison of average yields . 520
  Journal of Agricultural Research, The 223
  Rice Harvest, The, *by Doreen Hungerford* 498
  tractor production 225

B

Bananas
  breeding work 56
  commercial characters of Gros Michel 57
  control of diseases 56
  increase in N.S.W. 487
  production of 56
  selection and testing of seedlings . 58
  sterility in 57
  transportation methods for . . 58
Barley
  British malting 407
  demand for 407
  Malting, Characteristics of, *by A. Cory Wright* 451
  U.S. production 92
  world production 184
Barleys
  British, improvement of . . . 408
  Danish and British, quality of . . 410
  varieties suitable for malting . . 452
Bees (*ed.*) 233
Belgian Congo, future plans for . . 117
B.I.F., agricultural exhibits at the. . 299
Biological control of insect pests . . 459
Blister blight
  control 346
  control developments . . . 485
  description of disease . . . 346
  effect on tea industry of Ceylon. . 346
  protective measures for . . . 347
  the spraying problem . . . 348
Botanical Congress, 7th International . 359
Brazil
  agricultural production in . . 230
  banana exports 184
  cocoa crop of 446
  coffee exports. 275
  high quality of coffee . . . 520
Brazilian
  agricultural tour 358
  cotton industry, pests of . . . 507
  nut production 276
Brazil's Cotton Industry *by Col. C. E. Ponsonby* 507
Breadgrain, world production in 1949 . 10
Breeding of Disease-resistant Bananas, The, *by K. S. Dodds* . . . 56
British
  agricultural policy (*ed.*) . . . 93
  Association, annual meeting, 1950 . 359
  Colonial Agriculture (*book review*) . 344
  Colonies, soil conservation in the . 305
  farming, U.S. aid for . . . 265
  Guiana, mechanised rice production in 420
  Standards Institution . . 141, 445
  West Indies, sugar production in . 365
Buckwheat, India introduces . . 332
Burma
  edible oil production . . . 230
  rice production in 137
  sesame in 220
B.W.I.
  sugar estimates 276
  threat to cocoa (*ed.*) . . . 490

C

Cacao
  measures against wilt of . . . 336
  production in Trinidad and Tobago . 183
  production, world estimates . . 275
California, citrus pests in . . . 263
Cameroons, increased production in . 59
Canada
  British farm machinery in . . 41
  British scientists to visit . . . 327
  estimated crop areas in . . . 402
  Grand Coulee Dam in (*ed.*) . . 279
  soya bean harvest in 1949 . . 46
Canadian linseed acreage . . . 446
Cape Province pineapple industry . 369
Cashew crop in India 276
Castor beans production in South Africa 156
Cereals
  barley, spring 227
  flour mill for Mozambique . . 274
  highest yielding—maize . . . 5
  hybrid maize in Southern Rhodesia . 272
  maize, experiments in France . . 265
  in U.S.A. 275
  Mexican production of . . . 229
  millets (*corres.*) 224
  oats, spring 227
  rye, estimated production for 1949 . 10
  wheat, Canadian acreage . . . 240
  Egyptian crop 360
  estimated production for 1949 . 10
  U.S. forecast 360
  world grain crops reviewed . . 248
Ceylon
  Blister blight control in . . . 485
  in tea. 346
  fewer coconuts in . . . 520
  mechanical tea harvesting in . . 133
  tea production in 316
Characteristics of British Malting Barleys *by H. Hunter* 407
Chemicals, Humus and the Soil (*book review*) 15
Chemotherapy and plant disease (*ed.*) . 186
Chemurgy
  and alcohol production . . . 425
  and synthetic fibre production . . 424
  origin and development of . . 423
Cherries (*book review*). . . . 164
Cheshunt Research Station . . . 239
Chile, oilseed crop of 402
Chinese Rice Cultivation *by G. A. C. Herkelots* 321
Citrus
  fruit, by-products industry in Italy . 98
  pests, biological control of . . 265
  pest control, fumigation for . . 264
  processing plant in Jamaica . . 63
  trees, Cyprus plants new . . . 402
Clove
  Growers' Association . . . 200
  Industry of the Zanzibar Protectorate, The, *by R. O. Williams*
    Part I 143
    Part II 198
  tree, improvement of the (*ed.*) . . 186
  Tree, The (*book review*) . . . 226
Clover
  Berseem, in South Africa . . . 173
  white, certification of seed . . 37
    characteristics of 35
    climatic needs 36
    export trade from New Zealand . 38
    harvesting 37
    insect pests. 38
Cloves
  cropping of 145
  cultivation of 144
  history of, in Zanzibar . . . 143
  in Zanzibar (*ed.*) 185
  inspection and marketing . . . 200
  length of life 200
  oil of 144
  replanting of trees 199
  sudden death disease in Zanzibar . 29
  'sudden death' disease of . . 198
  value of exports from Zanzibar . . 144
  world demand for 143
  Zanzibar's crop 402
Cocoa
  Brazilian crop 446
  production 230
  Chocolate and Confectionery Alliance, summary of 496
  control of capsid pests in . . . 190
  of 'swollen shoot' . . . 190
  cultivation, history of . . . 249
  need for research 251
  development in Bahia . . . 250
  farms in West Africa . . . 189
  French African markets . . . 224
  in West Africa (*ed.*). . . . 490
  insecticides and diseases of . . 191
  Liberian cultivation . . . 360
  the present situation . . . 496
  production in British Colonies . . 166
  in South America *by H. A. Tempany* 249
  two-day conference 359
  types grown 250
  virus disease in Trinidad . . . 64
  West African Research Institute . 190
Coconut cultivation, research into . 412
Industry of Ceylon, The, *by R. Child* 102
  products of the Ceylon . . 103, 104

Coconuts
attacked by a coreid bug in the Solomon Islands 3
history of cultivation, in Ceylon . 102
insect pests and diseases . . . 105
manuring of in Ceylon . . . 106
present acreage under coconut palms in Ceylon 103
production and consumption in Ceylon 104,105
production in Ceylon 520
production in Fiji 227
replanting of palms 106
Coffee
Brazilian exports 275
Columbia's exports 229
cross-breeding 180
diseases of 179
elimination of sterile hybrids . . 179
Haiti production 184
high quality of, in Brazil . . . 520
increase in Mexican exports . . 520
Industry, Review of 460
in the Eastern hemisphere . . 462
in the Western hemisphere . . 461
Mexican production 229
propagation 180
sources of supply 460
Colonial
Agriculture Service, recent promotions in the 101
Development Corporation (*ed.*) . . 361
Touring Exhibit 312
Colorado Beetle Campaign (*ed.*) . 290, 318
Columbia coffee exports 229
Commonwealth
Agricultural Bureaux (*ed.*) . . 491
history and development . . 357
mode of operations . . . 358
Review Conference, 1950 . . 514
sugar 93
Competition Between Natural and Synthetic Rubber *by G. Martin* . . 146
Compost
from sewage and refuse (*ed.*) . . 3
importance in Japan 65
in a Prison Camp *by F. C. Cooke* . 24
Composting
for the Disposal of Sewage and Refuse (*book review*) 25
methods used in Japan . . . 65
new Indian robot screen for . . 225
Conference
F.A.O.s annual, 1949 . . . 39
on Feeding Stuffs 182
Conferences, research vintage (*ed.*) . 447
Conservation
course, Cyprus offer . . . 260
legislation *by Sir Harold Tempany* . 511
recent developments . . . 511
two aspects of 469
Control
of Citrus Pests in California *by F. M. Read* 263
of Cocoa Diseases in West Africa, The, *by Robert A. E. Galley* . . . 186
Controlled grazing by electric fencing . 503
Corridor system. 372
Cotton
African study of 356
Egyptian varieties 138
production 446
estimated production in Egypt . . 46
in Greece 46
in Pakistan 46
in U.S.A. 46
in U.S.S.R. 46
expansion of Brazilian industry. . 507
hybridisation of South African . . 414
Manchester meeting 167
Mexican production 229
Pakistan's yields 360
production for 1949-50 . . . 46
Raw Cotton Commission's Report (*ed.*) 318
South African production . . 319
Texas' crop of 77
world developments in . . . 488
yields in Brazil 507
Crop
costing 254
description of 254
horse and tractor costs . . . 255
interpretation of results . . 257
protection, overseas work by Pest Control Ltd. 393
panel of S.C.I. (*ed.*) . . . 188
products, Government scheme for (*ed.*) 142
protectors 431
Crops
drought-sensitive and drought-resistant 115
histories of (*ed.*) 95
root depth and water consumption . 115
seasonal growth of 115
transpiration and weather conditions affecting 114
Under Glass in the Lea Valley *by W. F. Bewley* 238
water extraction from the soil . . 116
without soil (*ed.*) 185
Cuba, tobacco production in . . 402
Curtis, Harry A., brief history of . . 55
Cyprus
agricultural report of . . . 124
conservation course in . . . 260
new citrus plantings . . . 402
Soil conservation in . . . 471

D

Dairy Show, 1950, brief note on . . 502
Decennial reports (*ed.*) . . . 50
Desert, locust, the (*ed.*) . . . 450
Disease resistance, factors of (*ed.*) . 449
Disinfestation, methods for . . . 70
Dry farming in the tropics (*ed.*) . . 231
Dutch Fodder Bureau 383

E

EAAFRO's First Annual Report . 286
East Africa
extended rice cultivation in . . 142
group farming in 107
rice production in 166
sesame in 220
East African Agriculture (*book review*) . 273
East Malling
members' day 295
Research Station, members' day at . 441
annual report of 73
Economy
American agricultural (*ed.*) . . 139
British agricultural (*ed.*) . . 139, 278
Education, African agricultural (*ed.*) . 232
Egypt
'century storage' of water in . . 111
cotton crop of 138
estimate for 1949 46
cotton production in 446
cultivated areas of 258
drainage methods for . . . 112
Gezira irrigation scheme in (*ed.*) . 277
'perennial' and 'basin' irrigation in 110
soil and fertilisers in . . . 258
soil utilisation in . . . 111, 112
the Aswan Dam 111, 112
the Nile barrages in . . . 110
wheat crop of 360
Egyptian
agriculture 258
Irrigated Crops and Projected Hydro-electric Schemes *by J. Grindrod* . 110
seasons and crop rotations . . 259
Eire
1949, agriculture in 92
farm survey for 177
El Salvador, sesame production . . 275
Election
and agriculture (*ed.*) . . . 93
and overseas agricultural production (*ed.*) 139
result of 139
Electric Fencing
by J. H. L. Knocker . . . 503
capabilities and limitations of . 503
construction and wiring of . . 503
Electrified farming (*ed.*) . . . 447
Elephant Grass
by R. O. Whyte 384
as fodder 384
harvesting of 385
origin and characteristics of . 384
propagation of 384
Energy, demand for (*ed.*) . . . 447
England and Wales, estimated corn yields 520
Ensilage, modified method of making . 88
Entomological research, need for (*ed.*) . 448
Erosion
in Australia and Cyprus . . . 469
in British Colonies, need for basic information 308
legislation and co-ordination . . 308
reasons for increase in . . . 305
regions' losses through . . . 307
in Japan 215
soil, checked in Tennessee Valley . 47

F

F.A.O.
annual conference, 1949 . . . 39
fifth annual conference . . . 174
history of (*ed.*) 403
on use of fertilisers (*ed.*) . . . 47
permanent headquarters . . . 132
publications, reviews of . . 442, 443
work of (*ed.*) 96
Farm
development in Southern Rhodesia . 228
Machinery (*book review*) . . . 165
'Farm Face-lifting' 415
Farm face-lifting demonstrations
results of 419
organisation of 416
origin of 415
mechanisation
cause of increase in . . . 222
mounted implements . . . 222
Farmer Victorious (*book review*) . . 165
Farming
by Fire *by J. R. Thomson* . . . 396
corridor system 372
Picture in Tropical Africa, The, *by W. V. Blewett* 370
Fencing, electric 503
Fens, East Anglian, water table problems 74
Fertiliser
ammonia as a 214
Congress to be in Italy . . . 502
exports, decrease in U.S. . . . 502
use of night soil in Japan . . . 66
Fertilisers
aerial application of 383
and Grassland Production . . 201
consumption in tropical Africa . . 373
Dutch output of 39
F.A.O. on (*ed.*) 47
granular factory for Salisbury . . 401
in British Colonies (*ed.*) . . . 94
in combination with 2 : 4-D (*ed.*) . 4
in Japan 216
Italian output. 193
lime and grass production . . 202
livestock and (*ed.*) 320
nitrogenous and grass production . 202
in Japan 65
phosphate and grass production . 202
and white clover 36
in Japan 65
potash and grass production . . 202
in Japan 65
muriate and sulphate . . . 156
North German deposits . . 155
research by T.V.A. for cheaper . 53
South African supplies . . . 262
Russian, for Australia . . . 158
'test demonstration' farms in Tennessee Valley 54
U.S.A.'s industry 435
West German market 152
world production 64

Fibre
manila hemp in the Philippines . 79
production 79
Fibres, possible expansion of, in British Colonies 158
Fifteen Years of Chemurgy *by M. K. Schwitzer* 423
Fiji
agriculture in 227
insect pests of Tonga . . . 432
Fodder bank scheme for South Africa . 262
Foliar diagnosis
and Plant Nutrient Requirements *by E. J. Hewitt* 455
methods of 455
results of 458
Food, need for increased supplies in Britain 32
Forage Crops (*book review*) . . . 164
Ford Motor Co., new chairman for . 356
Fordson linkage system, construction and operation 268
Forest development in New Zealand . 30
Forestry, Fijian programme . . . 228
France
oilseed acreage in 360
olive cultivation in 206
shortage of machinery in . . . 89
wheat price uncertainty . . . 454
French Equipment Scheme . . . 225
Fruit
and application of dusts . . . 128
and atomising fluids . . . 128
Argentinan deciduous . . . 138
bananas, Brazilian exports . . 184
breeding disease-resistant . . 56
in Fiji 227
citrus, position of Italian by-products . 90
fly, control of 411
Italian crop 402
exports 229
Malaya's pineapple industry . . 86
Plums of England, The (*book review*) . 226
replacing Indian 426
Science (*book review*) . . . 443
soft, lectures on at East Malling . 441
spraying and the bee population (*ed.*) 233
automatic 127
developments in machinery for . 125
early methods 125
use of sprayer-duster for . . 129
Fuel economy, tractor . . . 484
Fumigants
for Pest Control in Stored Foodstuffs *by W. Burns Brown* . . . 241
sorption qualities of . . . 242
types of 242
Fumigation
of loose bulk 242
of packaged goods 241
Fungicides, development of (*ed.*) . . 404

G

Genetics in Russia (*ed.*) . . . 362
Germany
fertiliser production in . . . 152
grain harvest in 92
Grafting of olives 206
Grain and Seed
Cleaning Plant *by R. A. Colburn* . 389
storage of 28
'Dryvent' installation for . . 486
Grape, world production . . . 174
Grapes
in South Africa 488
output in Italy 90
Grass Driers—Their Construction and Operation *by P. H. Southwell* . . 159
Grasses
burning for cultivation in Sudan . 396
in rotation with rice (*ed.*) . . . 1
in Sudan 396
Lucerne, dried, for Transvaal . . 393
Grassland
and fertilisers 202
economic importance of . . . 204
fertilisers plus 2 : 4-D dressings to . 4
improvement, international conference on 265
management of 203
Grass-drying
machinery for 160, 161
principles of 159
under tropical conditions (*ed.*) . 140
value of (*ed.*) 140
Grazing
management 237
use of highland and lowland . . 235
Greece, cotton production in . . 46
Groundnuts
at Kongwa (*ed.*) 489
future of East African scheme (*ed.*) . 1
new report on O.F.C.'s accounts (*ed.*) 319
West African production . . . 166
Group farming
and group services 108
difficulties in planning . . 108, 109
origin and early developments . 107, 108
with Special Reference to East Africa *by G. B. Masefield* . . . 107

H

Haiti, lower coffee production . . 184
Hawaiian
Islands, pineapple industry of the . 283
pineapple industry, mechanisation of 283
research in the 284
Hides and Skins
by J. R. Furlong 349
colonial production of . . . 349
outlook for industry . . . 353
principle producing areas . . 350, 351
Hill country
afforestation of 292
Grasslands *by E. Bruce Levy*
Part I 235
Part II 291
grasslands, need for critical surveys of 292
replenishment of 291
Topdressing from the Air *by P. B. Lynch* 427
Hill grazing
potential source of production (*ed.*) . 232
secondary growth control . . . 236
Hill Land
Reclamation in Montgomeryshire *by W. Ellison* 341
reclamation, initial cultivation . . 341
pioneer crops 343
problems of 341
Holland
sugar beet and fodder crops in . . 78
wheat and barley production in . . 316
Honours, King's Birthday List . . 356
Hormones, plant, chemical nature of . 18
Horse *v.* tractor
(*ed.*) 187
(*corres.*) 274
Hortex, new insecticide . . . 221
Horticulture, biennial bearing . . 295
How Plant Hormones Aid Crop Production *by L. C. Luckwill* . . . 17
Humus, importance in Assam tea estates 280
Hybridisation and South African cotton 414

I

Importance of Humus in Assam Tea Estates, The, *by C. R. Harler* . . 280
India
and Pakistan, tea crops of . . 275
cashew production in . . . 118
fruit cultivation 426
increased food production in . . 59
introduces buckwheat . . . 332
jute industry of 401
Southern, coffee breeding in . . 179
tea exports of 446
tractor requirements of . . . 401
Indian cashew crop 276
Indonesia
development plan for . . . 74
palm oil industry of 245
rice production and consumption in . 21
Insect Pests
Biological Control of 459
of Tonga, types of 432
Insecticide
new German 221
new systemic 135
Insecticides
and diseases of cocoa . . . 191
and mammalian toxicity . . . 135
definition of systemic . . . 135
future of (*ed.*) 46
Parathion (*corres.*) 182
trivial names for (*ed.*) . . . 141
use in 'smoke' generators . . 72
Insects, Biological Races of (*ed.*) . . 448
Institution of British Agricultural Engineers Examination, new course . 401
International Superphosphate Manufacturers' Association, meeting of . 434
Iodine, experiments with . . . 348
Irrigation
Egyptian schemes 110
Grand Coulee Dam in Canada (*ed.*) . 279
Lower Sind barrage 200
Niger scheme (*ed.*) 49
overhead 438
Syrian projects 244
Israel, crop increase 488
Italian
crop production 446
fertiliser output 193
grain prospects 360
Italy
agricultural news from . . . 90
citrus fruit by-products in . . 90
Fertiliser Congress to be in . . 502
fruit and vegetable production in . 229
fruit harvest of 402

J

Jamaica
citrus-processing plant for . . 63
sugar production in 365
Japan
home-produced manures in . . 65
soils, crops and erosion in . . 215
topography of 215
vegetation of 215
Java, rubber research in . . . 430
Jordan
irrigation schemes for . . . 123
the Wadi Zerqa project . . . 129
June 4 returns 446
Jute
India's industry 401
Indo-Pakistanian forecast . . . 92
Kenaf as possible substitute . . 468
market conditions of . . . 132

K

Kenaf, new American crop . . . 468
Kongwa, groundnuts (*ed.*) . . . 489

L

Land
reclamation, Italian project . . 90
Use and Conservation in Japan . 215
use, planning and production (*ed.*) . 48
Lea Valley
characteristics of 239
glasshouse industry, history and growth of 238
Lebanon, The Litani River Investigation Project 129
Legislation, covering aspects of conservation 511
Liberian cocoa cultivation . . . 360
Lime, use in Britain (*ed.*) . . . 361
Linseed
Canadian acreage 446
U.S. production 92
Livestock, British African survey of . 167
Locusts
conference in Pakistan . . . 113
in Africa (*ed.*) 403

Locust threat, investigations to control . 483
Long Ashton, New British Power Duster 44
Louisiana, ammonia used as a fertiliser in 214

M

Machinery
'Agricultural Future of the General Purpose Vehicle' . . . 83
and petroleum 310
baler, lightweight one-man . . 400
blower-type topdressers . . . 427
British imports at minimum . . 88
Californian spray equipment . . 263
combine and swather . . . 181
costly French fuel 400
cultivator, general purpose rotary . 88
diesel tractor, 40 h.p. Loyd 'D' Model Tracklayer . . . 356
diesel tractors 310
'Dragon' crawler tractor . . 516
'Dryvent' installation . . . 310
earth-moving implement for Fordson tractor 181
electric hay dryer 445
expansion in Spain 486
Farm (*book review*) 165
in Canada 41
protection of in winter . . . 43
for overhead irrigation . . . 439
for pit silage-making . . . 394
for soil conservation . 338, 339, 375
Fordson linkage system; construction and operation 268
for fruit-spraying 126
for hay-making in Canada . . 42
for power dusting 128
for spraying infested cacao trees . 192
forage harvester 354
grass drier, new mobile . . . 313
Templewood Mark I . . . 271
grass driers, types of . . . 160
hammer-mill, new flail-type . . 315
harvester, new forage . . . 225
Holland's imports 356
Howard Rotovator 400
new type linkage and drive for . 518
hydraulic power lift . . . 222
jeep, for farm transport . . . 84
photographs of the . . . 133
post-war use of the . . . 83
use as farm tractor . . . 84
L.O. Estate sprayer . . . 516
loans for grass-drying . . . 134
mechanical tea harvester . . 133
mist blowers 348
mobile crop drier 518
mounted implements at Royal Show. 354
'Mounted Implements on the Farm' 222
mower blade grinder . . . 445
N.D.Agr.E., a new degree . . 519
N.I.A.E. exhibit of imported . . 297
N.Z. Tractor Market . . . 270
oil-fired drier 444
one-man seed drill 517
Overseas Buyers' Service . . . 517
plough, blade-weeder in Canada . 41
Canada's one-way disc . . 314
disc, in Canada 41
trailing, rolling and stump-jump disc 134
ploughs, furrow and disc . . . 356
rubber tyres on 270
pneumatic grain drier . . . 355
power duster, new British . . 44
robot screen for composting . . 225
Royal Show silver medal awards . 399
self-cleaning Wilder 'Pitchpole' . 45
shortage in France 89
spraying, for weed control in Canada. 42
spray manufacturers combine . . 271
Swiss import of tractor spare parts . 315
ten-ton/hour baler 444
terracers, blade, elevating, whirlwind 375
the 'Rapidcut' 314
three cwt./hr. conveyor grass drier . 517
tractor, continental 400
Fordson Major 88
Foreloda, attachments for . . 45
future of the (*ed.*) . . . 187
Italian industry 89
new one-cylinder 133
versus farm animal (*ed.*) . . 187
tractor-mounted tree puller . . 355
tractors
Australian production . . 181, 225
importance of (*ed.*) . . . 187
in India, import licences for . . 401
Mark VF diesel crawler . . 45
tracklayers 181
wheeled, in Canada . . . 41
trail and self-propelled types of forage harvester 386
U.K. increases 314
U.S. exports 270
Worm grain conveyor . . . 517
Maize
commercial types (dent and flint) . 6
history: Inca, Maya and Aztec civilisations 6
hybrid, in Italy 90
hybrid seed in Matabeleland . . 87
hybridisation in the U.S.A. . . 197
improvement in cultivation methods . 7
increased yields through hybrids . 8
mechanical harvesting . . . 7
origin, pod corn theory . . . 5
South Africa, future importance in production 7
South African crop 92
The Highest Yielding Cereal *by E. S. Bunting* 5
U.S. domination of production . . 6
U.S. production 92
Malaya
composting in Changi Prison Camp . 24
pineapples in 86
rice production and consumption . 23
rice production in . . 166, 183, 316
rubber production in . . 146, 167
Maleic Hydrazide as Growth Inhibitor 464
Mallee, soil conservation in the . . 469
Malt and Brewing, Types of, *by L. R. Bishop* 492
Malting
methods of 453
Process, The, *by A. Cory Wright* . 451
Malts
for different types of beer . . 453
stages in brewing process. . . 492
Man-hours, agricultural (*ed.*) . . 234
Manila Hemp Problem in the Philippines, The 79
Manual of Rice Diseases (*book review*) . 442
Marshall Aid for Anti-Locust Campaign 497
Matabeleland, loss of crops in . . 184
Mauritius sugar crop 446
Mechanisation, extension of, in the tropics 465
Mechanised Rice Production in British Guiana (*book review*) . . . 420
Mexican agricultural exports . . 229
Mexico
increase in coffee exports . . . 520
mechanisation in 34
new cultivation in 34
Rockefeller aid to 378
tobacco production in . . . 138
vanilla crop of 360
Middle East machinery markets, survey of 271
Milk Substitutes in Tropical Countries *by Lucius Nicholls* 157
Millets
conditions for growth . . . 97
cultivation of (*corres.*) . . . 224
economical importance . . . 98
future of 101
origin 97
The, *by H. H. Mann* . . . 97
types of 98, 99, 100
Mineral Nutrition (*book review*) . . 387
Mining and agriculture (*ed.*) . . 364
Minor Elements (*book review*) . . 273
Molybdenum in plant nutrition (*ed.*) . 405
Montgomeryshire, hill land reclamation in 341
Mounted Implements on the Farm *A. B. Lees* 222, 268
Mozambique
import control affects . . . 402
new flour mills for 274

N

N.D.Agr.E., a new degree . . . 519
Natal, sugar mill for 414
National Institute of Agricultural Engineering (*ed.*) 278
Nematodes
as Crop Parasites *by B. G. Peters* . 11
control measures 13
parasitic types 12, 13
root-knot eelworm, tropical pest . 14
species of 14, 15
New Crop Projects in North Central U.S.A. *by M. M. Hoover* . . 298
New Locust Threat (*corres.*) . . 483
New South Wales bananas, increase in . 487
New Year's Honours List . . . 67
New Zealand
aerial fertiliser application in . . 427
forests and timber in . . . 30
pastures in 235
pit silage-making in . . . 394
soil erosion in 237
tractor market 270
N.I.A.E.
account of work of the . . . 296
and frost protection investigations . 209
open day at the 296
Niger, Irrigation Scheme of the (*ed.*) . 49
North Africa, olive cultivation in . . 206
North Borneo, rapid agricultural recovery 26
Nut production in Brazil . . . 276
Nutrition, problem of, in tropics . . 157

O

Oats
U.S. production 92
world production 184
Office de la Recherche Scientifique Coloniale 168
Oil
edible, Burma's production . . 230
palm, characteristics of the . . 245
Oilseed
Chile's crops 402
French acreage of 360
South Africa's crops . . . 402
Oilseeds
sesame 218
U.S. production 92
Olive
Industry in France and North Africa, The 205
oil production in France . . . 206
Tunisian production . . . 229
Olives
adaptability of 206
climatic influence on . . . 205
cultivation of 206
grafting of 206
pests and diseases affecting . . 206
Turkish. 184
Orchard cultivation
and aeration 176
and capillarity 165
and weed control 176
Orchards
expansion of Southern Rhodesian . 312
frost control in, use of inversion layer 208
importance of location . . . 208
frost in, N.I.A.E. investigations . 209
protection methods . . . 208
Ordnance survey maps, explanatory texts for 388
Organic
Fertilisers' Association (*ed.*) . . 279
matter, modern conception of . . 430
research into 431
and soil management . . . 295
'Organic' versus 'chemical' manures (*ed.*) 2
Overhead Irrigation *by W. F. Riester* 438

climatic conditions for . . . 439
results of 440
Overseas Food Corporation's sorghum project 303

P

Pakistan
cotton yields in 46, 360
crop reports for 183
Islamic Conference at Karachi . . 55
rape and mustard in 487
rice acreage of 229
to increase tea production . . 173
Palm kernel, world exports . . . 276
Palm oil
industry, future of the 246
of Indonesia, The, *by J. Grindrod* . 245
post- and pre-war production 246, 247
uses for 246
Pastures
aerial seeding of 426
New Zealand and British . . . 236
pests and diseases of (*ed.*) . . 317
Pest
Control, Farmers' Handbook (*book review*) 227
Control Ltd., Open Day of . . 393
Infestation Laboratory, results of work of the 204
Killers must not be Man Killers *by W. E. Ripper* 474
Petroleum
as fuel for driers 311
on the Farm 310
Philippines
rice production and consumption in . 22
tobacco production in the . . 183
Phosphate and white clover . . . 36
Pineapple
cultivation, harvesting and processing 283
soil conservation and 283
Industry of the Hawaiian Islands (*book review*) 283
Pineapples
Cape Province industry . . . 369
post-war development plan . . 86
pre-war production in Malaya . . 86
Pine seedlings, research into feeding (*ed.*) 405
Plant
analysis, development of . . . 455
Breeding (*book review*) . . . 477
Growth Regulators and Fruit Trees . 178
hormones, for control of fruit drop 20, 178
in control of flowering . . . 19
seedless fruits 19
use as weedkillers 20
introduction, organisation in the U.S.A. 298
nutrient, sodium as a 333
nutrients, new theories on (*ed.*). . 490
Protection Ltd., new chemical produced by 431
opening of laboratory extensions . 502
Plantation
agriculture, weakness of (*ed.*) . . 450
Crops (*book review*) 477
Plants, transpiration of water by . 117
Ploughing grants 445
Plums of England, The (*book review*) . 226
Potassium
and plant growth 154
catalytic qualities 154
effect on nitrogen supply . . 154
fixation 155
Master Nutrient *by D. P. Hopkins* . 153
supplies in soil 155
Potatoes
storage of 28
world production of, in 1949 . . 40
Practical Problems of Sawmilling in the Tropics *by W. F. Chipp* . . . 328
Price
review, the annual (*ed.*) . . . 186
Support—A Permanent Farm Programme *by Harry W. Henderson* . 150
Agricultural Act for 1949 . . 151
C.C.C.'s new policy . . . 152
Commodity Credit Corporation . 150
description of 151
Truman on (*ed.*) 319
Principles and Practice of Cider-making (*book review*) 304
Problems of Selective Weedkilling, The 252
Progress in Fruit-spraying Methods *by M. H. Moore* 125
Propagation
easier through use of plant hormones. 18
of Plants (*book review*) . . . 510
Pros and Cons of Orchard Cultivation, The, *by A. C. Goudie* . . . 175
Protection of Orchards from Frosts . 208
Pulp and paper industry in South Africa 473

Q

Quality, need for, in agriculture (*ed.*) . 448
Queensland, sugar production of . . 332

R

Rape and mustard in Pakistan . . 487
Raspberry industry, Scottish
cane-nursery system . . . 289
frost, pests and virus diseases in the . 289
harvesting and marketing conditions . 288
history of 287
Reclamation, land, Italian project for . 90
Refuse, disposal of, by composting . 3
Research
and labour production . . . 193
by Pest Infestation Laboratory . . 204
Resistant crop varieties, evolution of (*ed.*) 449
Review Conference of the Commonwealth Agricultural Bureaux . . 514
Rhodesia
Northern, sugar and rice production of 411
Southern, agricultural plans . . 16
development of Upper Zambesi . 87
plans for 82
Rice
American aid to British Guiana . 39
Argentine acreage in 1949 . . 46
Chinese, cultivation methods . . 321
harvesting of 323
threshing of paddy . . . 323
decline in world production . . 487
economic importance in Japan . . 217
Enrichment *by P. Ringnes and G. K. Parman* 293
harvesting of 422
improved Indian 324
varieties 388
improvement of diets . . . 293
in Australia 498
in Burma 137
in East Africa (*ed.*) 142
in Malaya and East Africa . . 166
in Morocco 38
in Siam 137
irrigation and drainage of. . . 420
Malayan production . 23, 183, 316
methods of cultivation in Indonesia . 21, 22
problem of manuring (*ed.*) . . 404
production and consumption in Indonesia 21
in the Philippines . . . 22
Roche enrichment process . . 294
rotational cultivation of, in U.S.A. (*ed.*) 1
Supplies in South-East Asia . . 21
synthetic vitamins and . . . 293
tapioca as substitute for . . . 432
varieties in British Guiana . . 421
world production lower . . . 163
prospects 446
Rockefeller Foundation, 1949 review of the 378
Rothamsted Report (*book review*) . . 478
Royal Agricultural Society of England, the Royal Show, 1950 . . . 320
Royal Agricultural Show for Southern Rhodesia 272
Royal Show, 1950
educational exhibits of . . . 398
report of the 398
Royal Society of Arts 419
Rubber
Act of 1948 75
advantages of synthetic . . . 147
cost of producing plantation and synthetic 147
diseases 76
grading of natural (*ed.*) . . 141, 148
in Western Hemisphere . . . 76
in West Java 430
leaf diseases of 146
Malayan production . . . 167
natural versus synthetic . . . 26
necessity for natural . . . 75
political importance of natural . . 146
production in Malaya . . . 146
in the Orient 75
specifications for natural . . 141, 148
Russia
genetic science in (*ed.*) . . . 362
increases crop targets . . . 520
Rye
and drift control 130
Australian varieties 131
elimination in England and France . 61
estimated production for 1949 . . 10
for control of soil erosion . . . 130
for Drift Control and Grazing in Australia *by H. J. Sims* . . 130
for grazing 130
hay and grain, value of . . . 132
importance of U.S.S.R.'s production 61
in bread manufacture . . . 61
marling of 62
new Dutch variety 124
origin 60
preference for wheat as a bread grain 61
resistance to low temperatures and low soil fertility. 60
The Bread Grain of the Colder Lands *by H. Hunter* . . . 60
use of straw 62
U.S. production 92
varieties of 63

S

Safety factors, tractor 479
Safflower seed
derivation 136
feeding value of 136
Salad Crops Under Glass (*book review*) . 226
Salisbury, granular fertiliser factory for. 401
Saltbush, descriptions of species . 266, 267
Saltbushes
and soil conservation . . . 266
of South Australia, The, *by R. W. Jessup* 266
Sawdust, value as soil improver . . 358
Sawmills, types of 328
Sawmilling
economy 329
fuel for use in 331
power requirements for . . . 329
procedure 331
Scottish Raspberry Industry, The, *by C. H. Cadman* 287
Seed-cleaning plants, types of . 389-393
Seeds
Canadians asked to increase linseed . 257
spring 227
Selective weedkillers
research on 252
Safety precautions when using DNOC and Parathion 272
Selective weedkilling
low-volume spraying . . . 253
plant development and . . . 252
resistance of cereal crops to . . 254
Sesame
characteristics 218
cultivation of 220
economic importance . . . 218
El Salvador production . . . 275
harvesting of 221
improvement of 220
in Burma 220
in East Africa. 220
in the Sudan 220
Potentialities of, *by A. E. Haarer* . 218

pre-war production 219
world acreage 218
Seventh International Botanical Congress *by Erna Grossbard* . . . 481
survey of 481
Sheep Husbandry (*book review*) . . 304
Siam, rice crop of 137
Sir Rowland Smith, Ford chairman . 356
Sisal
problems (*corres.*) 345
Tanganyika's production . . . 229
weevil, control of 182
Small Tropical Farm and Mechanisation 465
Smithfield Show
Overseas Buyers' Service . . . 517
The 91
'Smoke' generators
description of 71, 72
for Protecting Stored Crops *by H. W. Chatfield* 70
Snowy River Project
for hydro-electric power . . . 68
increase in irrigated areas through . 69
Society of Chemical Industry, crop protection panel (*ed.*) . . 96, 188
Sodium
analogy with trace elements . . 333
as a Plant Nutrient *by D. P. Hopkins* 333
effect on crop quality . . . 335
status of 333
Soil conservation
erosion in New Zealand . . 237
implements for use in . . 338, 339
in South Africa 261
in the British Colonies . . . 305
one-day demonstrations of (*ed.*) . 406
soil tillage and 337
South African Committee for . . 359
structural methods of . . . 376
subsoiling, listing and ridging . . 340
Soils
British, lime and 361
heating of (*ed.*) 233
Organic Matter in the Tropics . 430
Science, 4th International Conference of 359
sterilisation of (*ed.*) 233
Soilless food production (*ed.*) . . 185
Solomon Islands, coconuts attacked by coreid bug in 3
Somaliland Farms, Italy to Improve . 274
Some Trials with Pit Silage-making in New Zealand *by R. H. Cochrane* . 394
Sorghum
dwarf 441
results of Overseas Food Corporation's project 303
Soil fertility, new theory by Ingham (*ed.*) 490
South Africa
Berseem clover in 173
cotton crop of 316
expanding pulp and paper industry . 473
increase in maize crop . . . 520
maize crop of 92
new sugar mill for 152
oilseed crops of 402
popularity of table grapes . . 488
Soil Conservation Committee for . 359
soil conservation in 261
to produce castor beans . . . 156
1950 vine sale at Paarl . . . 414
South African
agricultural standardisation . . 262
cereal crops in 1949 . . . 300
farms, mechanisation of . . . 261
fertiliser supplies 262
fodder bank scheme . . . 262
vegetable and fruit crops in 1949 . 301
South America, cocoa production in . 249
South Australia, soil survey . . . 16
Southern Rhodesia
crop prospects 184
farm development in . . . 228
hybrid maize in 272
new agricultural college . . . 224
new sugar refinery for . . . 180
orchard expansion in . . . 312
Royal Show for 272
water conservation in 274
South Pacific Commission
by Eric Ford 412
plant introduction and . . . 412
summary of work of the . . . 412
Soya bean
U.S. production 92
world production 137
Spain
agricultural developments in . . 210
tobacco production 276
Spain's Machinery Expansion . . 486
Storage, grain and potato . . . 28
Sudan
cultivation of sesame in the . . 220
grasses of 396
Gezira in retrospect (*ed.*) . . . 277
importance of sorghum . . . 397
Sugar
(*book review*) 344
B.W.I. estimates 276
in Jamaica 365
irrigation and research in Jamaica . 366
Mainstay of the British West Indies *by A. C. Barnes*
Part I 325
Part II 365
market conditions (*ed.*) . . . 93
Mauritius crop 446
mill for Natal 414
molasses and alcohol production in U.S. 379
new mill for South Africa . . 152
new refinery for Southern Rhodesia . 180
production in British Colonies . . 166
in Fiji 227
Queensland's production . . . 332
refined, Mexican production . . 229
U.K. markets 230
West Indian, history of . . . 325
production 360
world production 92
Sugar beet
European area 316
in Holland 78
new dressing for 172
new U.S. process for . . . 399
Swedish increase 316
U.S. forecast 275
Sugar cane
and aqueous ammonia . . . 214
cultivation 212
history of 211
importance as a foodstuff . . . 211
pests and diseases 213
research and economic importance of 213
varieties 212
West Indian (*ed.*) 317
Suppression of Weeds by Fertilisers and Chemicals (*book review*) . . . 164
Sweden, increased sugar beet production in 316
Switzerland, tobacco output . . 183
Swollen shoot
cocoa in West Africa (*ed.*) . . 490
control, progress in 496
Syria, The Ghab Valley Project . . 129
Syrian irrigation projects . . . 244

T

Tanganyika
sisal crop of 229
timber development in . . . 34
Tapioca as a rice substitute . . . 432
Tea
blister blight control of Ceylon's . 346
(*book review*) 345
Ceylon's production . . . 316
cultivation, composting and . . 281
value of organic matter in . . 280
value of shade trees in . . . 282
Exhibition at the Tea Centre . . 87
Indian exports 446
in India and Pakistan . . . 275
leaves, mechanical harvester for . 133
origin and expansion . . . 280
Pakistan's production to be increased 173
soils, scientific study of . . . 280
use of artificial fertilisers for . . 281
Tennessee Valley, 'test demonstration' farms for fertilisers in . . . 54
The Sugar Cane *by A. C. Barnes* . . 211
Tillage methods, new laboratory for research 64
Timber
Colonial production . . . 167
in New Zealand 30
in Tanganyika 34
Tobacco
Argentinan crop 275
Cuban production 402
Mexican production . . . 138
Philippine imports of . . . 183
Spanish production 276
Swiss output 183
Turkish marketing conditions . . 137
U.K. imports 229
Venezuelan production . . . 276
Tomato Diseases (*book review*) . . 442
Tomatoes and plant hormones . . 19
Topdressing, Aerial 464
Toxic
chemicals in tropical climates (*ed.*) . 450
hazards, precautions against . . 475
Trace elements in the U.S.A. . . 435
Tractor
Fuel Economy 484
future of the (*ed.*) 187
Safety Factors 479
stability, mechanical factors influencing 479
Transvaal, dried lucerne for . . 393
Trinidad and Tobago, cacao production in 183
Tropical farm mechanisation, limitations of 466
Tropics
dry farming in the (*ed.*) . . . 231
problem of nutrition in the . . 157
Truman, President, on Price-Support (*ed.*) 319
Tunisian olive oil production . . 229
Turkey
improvement in tobacco market . 137
olive-growing in 184
Turkey's new Minister of Agriculture . 358
Turner, Sir James, speech to Royal Society of Arts 32
T.V.A.
aim to produce cheaper fertilisers . 53
area covered by 52
development of agriculture . . 53
flood control of Tennessee river . 52
history of the project . . . 51
hydro-electric and steam electric power 53
importance in checking soil erosion (*ed.*) 47
improvements in standard of living . 52
navigation on the Tennessee river . 52
phosphate production and the . . 436
'T.V.A. — The Tennessee Valley Authority' *by Harry A. Curtis* . 51
2 : 4-D (*ed.*) 4
Two Aspects of Conservation . . 469
Types of Malt and Brewing *by L. R. Bishop* 492

U

UNSCCUR
seven volumes on (*ed.*) . . . 363
value of (*ed.*) 363
U.S.A.
agricultural output of . . . 345
fertiliser exports decreasing . . 502
Fertiliser Industry 435
research in 437
hybridisation of maize in . . . 197
maize crop of 275
wheat forecast of 360
winter wheat production in . . 316
U.S.
Aid for British Farming . . . 265
cotton crop for 1949 . . . 46
exports of farm machinery . . 270
need for basic research . . . 506
sugar beet forecast 275
U.S.S.R., estimated cotton crop for 1949 46

V

Vanilla, Mexican crop . . . 360
Vegetable Growers' Guide (*book review*) 344
Vegetables
  Italian exports 229
  new research station for . . . 40
Venezuelan tobacco production . . 276

W

Waite Agricultural Research Institute (*book review*) 433
Water
  and capillary movements. . . 117
  conservation in Southern Rhodesia . 274
  Table, controversy on the . . 74
  Utilisation by Crops *by E. W. Russell* 114
  crops and (*ed.*) 95
Weather
  and agriculture (*ed.*) . . . 188
  conditions, control of (*ed.*) . . 188
Weedkillers, 2 : 4-D 4
Weeds, as pointers to soil fertility. . 458
West Africa
  groundnut production in . . . 166
  marketing problems in . . 120, 121
  post-war marketing boards for produce 121
  research in 123
  threat to cocoa (*ed.*) . . . 490
West African Farmer and World Markets, The, *by W. L. Bloomfield* . . 119
West Indies
  agricultural report on . . . 324
  cane sugar industry of . . . 325
  sugar (*ed.*) 317
  sugar production of. . . . 360
Wheat and barley, Dutch crop . . 316
Wheat
  estimated production for 1949 . . 10
  price uncertainty in France . . 454
  production in Italy 90
  U.S. production 92
Wheat and rice in Australia. . . . 487
White Clover Seed in New Zealand *by C. C. Leitch* 35
Wine
  world production 276
  1950 vine sale at Paarl . . . 414
Winter
  hardiness, application of soluble salts 309
  wheat, fall in U.S. production . . 316
Working party, report of, at Kongwa (*ed.*) 489
WORLD CROPS' Anniversary (*ed.*) . . 361
World Problem of Erosion, Soil Conservation Machinery, The, *by P. H. Southwell*
  Part I 337
  Part II 375

Y

Yeast, protein value of (*ed.*). . . 185
Young Farmers' Club Movement, The, *by M. Hiles* 169
  activities of 171
  colonial and international activities . 172
  history of 169
  organising and governing of . 170
Young Farmers' Club and 4H Club (*ed.*) 142

Z

Zanzibar
  clove crop of 402
  the clove industry of 143

AUTHOR INDEX

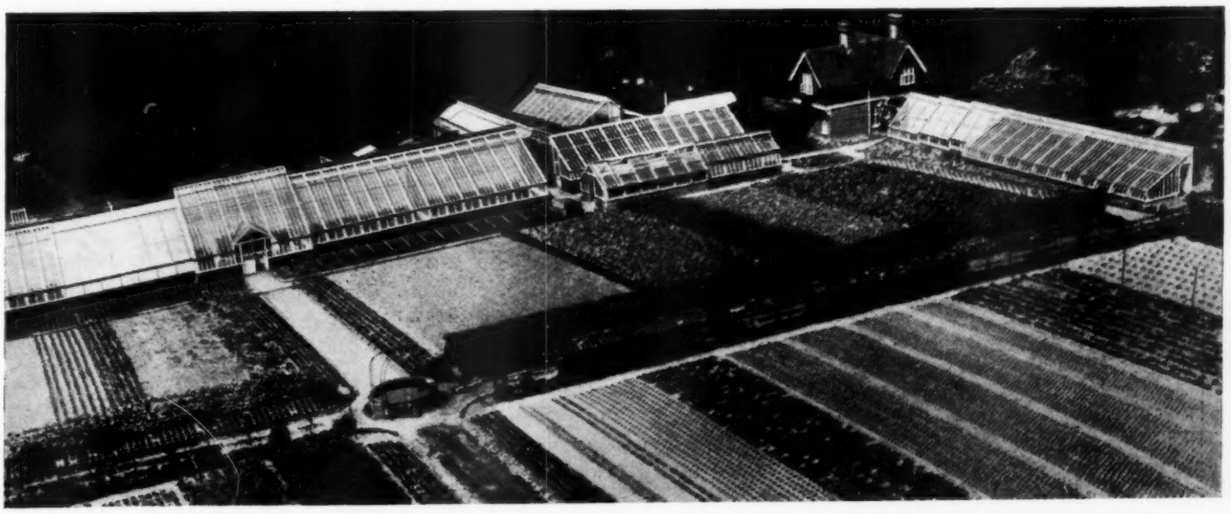
BARNES, A. C.: Sugar: Mainstay of the British West Indies
  Part I 325
  Part II 365
  The Sugar Cane 211
BEWLEY, W. F.: Crops Under Glass in the Lea Valley 238
BISHOP, L. R.: Types of Malt and Brewing 492
BLEWETT, W. V.: The Farming Picture in Tropical Africa 370
BLOOMFIELD, W. L.: The West African Farmer and World Markets . . . 119
BONNET, P.: The Olive Industry in France and North Africa 205
BROOKES, A. J. : Sheep Husbandry (*book review*) 304
BUNTING, E. S.: Maize—The Highest Yielding Cereal 5
BURNS BROWN, W.: Fumigants for Insect Control in Stored Foodstuffs . . 241
CADMAN, C. H.: The Scottish Raspberry Industry 287
CHALLINOR, S. W.: The Principles and Practice of Cider-making (*book review*) 304
CHATFIELD, H. W.: 'Smoke' Generators for Protecting Stored Crops . 70
CHILD, R.: The Coconut Industry of Ceylon 102
CHIPP, W. F.: Practical Problems of Sawmilling in the Tropics . . . 328
COCHRANE, R. H.: Some Trials with Pit Silage-Making in New Zealand. . 394
COLBURN, R. A.: Grain and Seed Cleaning Plant 389
COOKE, F. C.: Compost in a Prison Camp 24
CORY WRIGHT, A.: Barley and Brewing II—The Malting Process. . . 451
CURTIS, H. A.: TVA—The Tennessee Valley Authority 51
DODDS, K. S.: The Breeding of Disease-Resistant Bananas 56
ELLISON, W.: Hill Land Reclamation in Montgomeryshire 341
FURLONG, J. R.: Hides and Skins . . 349
GALLEY, R. A. E.: The Control of Cocoa Diseases in West Africa . . . 189
GOUDIE, A. C.: The Pros and Cons of Orchard Cultivation . . . 175
GRINDROD, J.:
  Egyptian Irrigated Crops and Projected Hydrolectric Schemes . 110
  The Palm Oil Industry of Indonesia . 245
GRIST, D. H.:
  Agriculture in Cyprus (*book review*) . 124
  Clove Tree, The (*book review*) . 226
  Composting for the Disposal of Sewage and Refuse (*book review*) . . 25
  Mechanised Rice Production in British Guiana 420
  Manual of Rice Diseases (*book review*) 442
  The Pineapple Industry of the Hawaiian Islands (*book review*) . . 283
GROSSBARD, E.: Antibiotics and Plant Protection 194
HAARER, A. E.: Sesame: Potentialities of an Ancient Oil Seed Crop under Modern Conditions 218
HAMILTON, R. A.: Fertilisers and Grassland Production 201
HARLER, C. R.: The Importance of Humus in Assam Tea Estates . . 280
HARPER, J. L.: Advances in Agronomy (*book review*) 387
HENDERSON, HARRY W.: Price Support—A Permanent Farm Programme 150
HERKLOTS, G. A. C.: Chinese Rice Cultivation 321
HEWITT, E. J.:
  Foliar Diagnosis and Plant Nutrient Requirements 455
  Mineral Nutrition (*book review*) . 387
HILES, M.: The Young Farmers' Club Movement 169
HOBBES, JOHN C.: The Manila Hemp Problem in the Philippines . . 79
HOBBIS, E. W.: Cherries (*book review*) . 164
HOBLYN, T. N.: Plums of England, The (*book review*) 226
HOOVER, M. M.: New Crop Projects in N. Central U.S.A. 298
HOPKINS, D. P.:
  Potassium—Master Nutrient . . 153
  Sodium as a Plant Nutrient . . 333
  Suppression of Weeds by Fertilisers and Chemicals (*book review*) . 164
HUNGERFORD, DOREEN: The Australian Rice Harvest 498
HUNTER, H.:
  Characteristics of British Malting Barleys 407
  Rye—The Bread Grain of the Colder Lands 60
JESSUP, R. W.: The Saltbushes of S. Australia 266
KNOCKER, J. H. L.: Electric Fencing . 503
LEES, A. B.: Mounted Implements on the Farm 222
LEITCH, C. C.: Production of White Clover Seed in New Zealand . . 35
LEVY, E. B.: Hill Country Grasslands
  Part I 235
  Part II 291
LUCKWILL, L. C.: How Plant Hormones Aid Crop Production . . . 17
LYNCH, P. B.: Hill Country Top Dressing from the Air 427
MANN, H. H.: The Millets 97
MARTIN, G.: Competition between Natural and Synthetic Rubber . . 146
MASEFIELD, G. B.
  Agriculture in Soviet Russia (*book review*) 77
  Agriculture in the Belgian Congo (*book review*) 117
  Group Farming with Special Reference to East Africa 107
MAYNE, J. E.: The Small Tropical Farm and Mechanisation 465
MOORE, M. H.: Progress in Fruit-Spraying Methods 125
NICHOLLS, L.: Milk Substitutes in Tropical Countries 157
PARMAN, G. K.: Rice Enrichment . 293
PETERS, B. G.: Nematodes as Crop Parasites 11
PONSONBY, COL. C. E.: Brazil's Cotton Industry 507
PRESTON, A. P.: Fruit Science . . 443
READ, F. M.: Control of Citrus Pests in California 263
RIESTER, W. F.: Overhead Irrigation . 438
RINGNES, P.: Rice Enrichment . . 293
RIPPER, W. E.: Pest Killers must not be Man Killers 474
RUSSELL, E. W.: Water Utilisation by Crops and the Ability of Soils to Supply Water to Them 114
SCHWITZER, M. K.: Farmer Victorious: Money, Mart, and Mother Earth (*book review*) 165
  Fifteen Years of Chemurgy . . 423
SIMS, H. J.: Rye for Drift Control and Grazing in Australia 130
SOUTHWELL, P. H.:
  Agricultural Future of the General Purpose Vehicle, The . . . 83
  Grass Driers—Their Construction and Operation 159
  Soil Conservation Machinery
    Part I 337
    Part II 375
SWANSON, C. L. W.: Land Use and Conservation in Japan 215
TEMPANY, H. A.:
  British Colonial Agriculture (*book review*) 344
  Cocoa Production in South America (*book review*) 249
  Conservation Legislation . . . 510
  Farm Machinery (*book review*) . . 165
  Soil Conservation in the British Colonies 305
THOMSON, J. R.: Farming by Fire . 396
WHYTE, R. O.:
  Elephant Grass 384
  Forage Crops (*book review*) . . 164
WILLIAMS, R. O.: The Clove Industry of the Zanzibar Protectorate
  Part I 143
  Part II 198
WOOLF, E. M.: Tomato Diseases . 442

MERCURY COMPOUNDS

SEED BORNE DISEASES OF CEREALS (*SMUT · BUNT · LEAF STRIPE · ETC*) AND OF PEAS	**LEYTOSAN**
FOR BULBS, TOBACCO AND SUGAR	**LEYTOSOL**
CABBAGE ROOT MAGGOT, CLUB ROOT, ONION FLY	**4% CALOMEL DUST**
WHITE ROT OF ONIONS	**'CALOTOX'**
FOR MOSS ON LAWNS	**MERCURISED TURF SAND**
FOR PATHS AND HARD COURTS	**MOSS KILLER**

TESTED AT TILGATE Modern understanding of the use of mercury controls has owed not a little to our Tilgate Research Station, a corner of which is shown below. We are always prepared to undertake investigations on the application of mercury for the control of plant pests and diseases.

Send for your copy of 'The Tilgate Story'



F. W. BERK & CO. LTD., THE MERCURY SPECIALISTS, 1/19 NEW OXFORD STREET, LONDON, W.C.1

TAS/BK. 293

THE WORLD'S NEED...

ORGANIC MANURE

Whether you are dealing with a small back garden or farming by the thousands of acres; whether your waste vegetation amounts to only a ton of haulms, stalks and weeds or whether you have on your hands tens of thousands of tons of straw or other material which would otherwise go to waste . . .

TURN IT INTO RICH MANURE

BY THE *Fertosan* METHOD

which is faster, cheaper and easier than any other.

FERTOSAN IS ENTIRELY ORGANIC

It contains a carefully determined number of bacteria, rendered dormant by a new process, which ensures later activity. When released on to your waste vegetation they feed and multiply, causing comp'ete rotting into humus-laden compost—

IN 5-6 WEEKS ONLY.

Sold to gardeners, nurserymen, farmers and estate and plantation owners the world over in units of 1, 4, 20, 60 or 100 tons (finished compost).

Apply for full details and prices to :—

FERTOSAN LTD
(Dept. 24)
WOLVERHAMPTON
ENGLAND

A REVOLUTION
IN GREEN CROP HANDLING
—Slashing Labour Costs to a Minimum

THE 'WILDER-STEED' WINDPROOF LOADER AND SELF-EMPTYING TRAILER

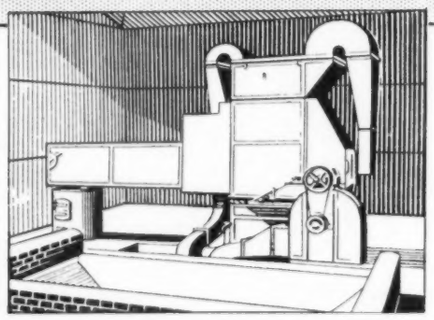
—A Complete One Man Outfit

★ Awarded a Gold Medal and 1st Prize of £750 by the Royal Agricultural Society of England at the Forage Harvesting Machinery Trials held at Shillingford this year. Write for details to—

Manufacturers of Agricultural Machinery to H.M. King George VI

JOHN WILDER LTD.
Agricultural Engineers
WALLINGFORD · ENGLAND
TELEPHONE WALLINGFORD 2122/3

The **KENNEDY & KEMPE**
GRAIN DRIER



DEALS with the output of up to a 12 ft. Combine Harvester. Drying and pneumatic elevation (by a single fan) of wet and dry grain—wheat, oats, barley, linseed, mustard, etc. and all small seeds.

Supplied to elevate wet grain from pit (illustrated) or a small wet grain hopper. Coke and Oil fired. Average capacity 1¼ tons per hour; 6% moisture extraction.

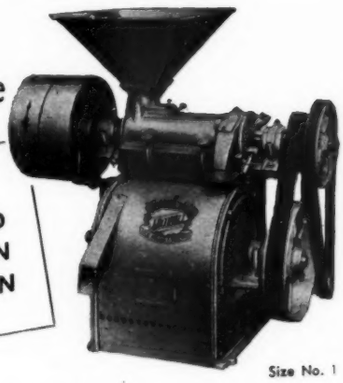
Grain can be passed direct to Silos by exhaust air from Drier Fan only. Illustrated literature available on request and our Technical Staff will gladly advise you, without obligation, on suitable installations.

Call on us at STAND 92 SMITHFIELD SHOW

Over 500 K. & K. Grain Driers are in operation in all parts of the World

KENNEDY & KEMPE LTD.
Manufacturers of GRAIN and GRASS DRIERS
Harewood Forest Works · Longparish · Andover · Hants
Telephone: LONGPARISH 224 Telegrams: "KENNEDY · LONGPARISH"
BRANCH WORKS : ROSE MILLS · ILMINSTER · SOMERSET

Reliability at the right price



PADDY TO ASPIRATED WHITE RICE IN ONE OPERATION

Size No. 1

The new Ancomill is an outstanding machine in design, performance and reliability. Its many refinements include ball bearings at all rotating parts, high-efficiency suction fan, fast and loose pulleys and stout belt-shifter. It is simple to work, efficient in operation and can be supplied for early delivery. All spare parts are readily available from stock. Also supplied as a complete self-contained unit, with the latest Petters B.2 oil engine, the Ancomill is the finest value obtainable today.

THE NEW ANCOMILL
RICE HULLER AND POLISHER

Sole Manufacturers

ALLIED NATIONAL CORPORATION LTD (PLANTATION MACHINERY DEPT)
ANCO HOUSE · BUCKINGHAM GATE · LONDON · SW1

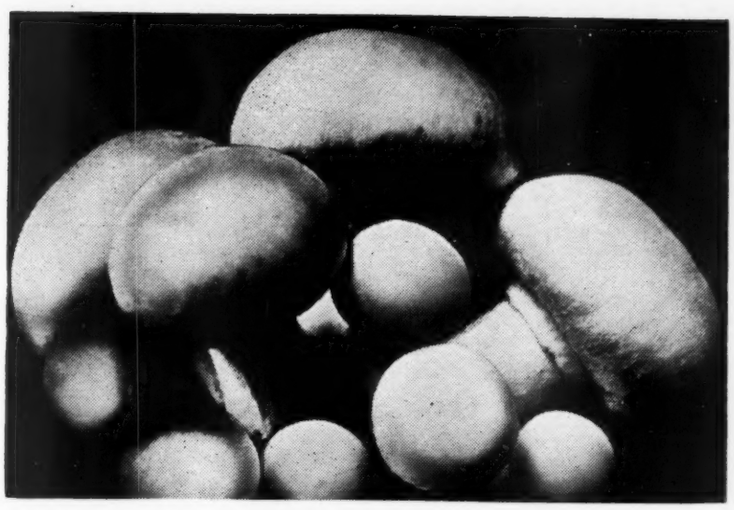
Patentees of the renowned "WEMANCO" Rice Milling Machinery

Of interest to MUSHROOM GROWERS

With its scientific background, built up by many years of careful research and practical experience, 100% Pure Culture Mushroom Spawn continues to lead the world in the production of prolific crops of fine quality Mushrooms, unique for their weight, size, flavour and colour.

100% Spawn is processed by our own exclusive methods of spore germination and propagation which ensure that only uniformly strong and vigorous strains are used for production, each step of which is laboratory controlled by qualified technicians. These methods are your guarantee of the highest possible quality pure culture Mushroom Spawn that science can produce.

A complete range of literature, dealing with all aspects of Mushroom cultivation, will be sent on request to any grower.



A cluster of Mushrooms from Darlington's 100% Spawn

MAY WE HELP? *Our Research and Advisory Department is laboratory equipped to carry out the examinations and analysis that you may need. It is staffed by qualified men, well versed in both practical and scientific aspects of Mushroom production, who are there to serve you. . . . If you have any Mushroom problems, please do not hesitate to write to us. We shall be happy to help you.*

W. DARLINGTON & SONS LTD

SOUTHCOURT ROAD, WORTHING, SUSSEX

MT5B

EDECO

WATER BORING & PUMPING EQUIPMENT

EXPLORATION · DRILLING · PUMPING

CATALOGUES AVAILABLE ON APPLICATION

ENGLISH DRILLING EQUIPMENT Co. Ltd.

BILBAO HOUSE · 36-38 NEW BROAD STREET · LONDON · EC2

Telephone: London Wall 1991 & 1992 Telegrams: "Bullwheel" Ave, London

EDECO TRINIDAD LTD

P.O. Box 27 : San Fernando : Trinidad : B.W.I. Telephone: San Fernando 2819

AGENTS :—

Vickers & Metropolitan Carriage (S.A.) Ltd., P.O. Box 1137, Johannesburg, South Africa
British East Africa Corporation (1939) Ltd., P.O. Box 182 Nairobi
Sir Keith Smith, 247 George Street, Sydney, Australia
Killick Nixon & Co. Ltd., Home Street, Bombay and Wallace Road, Karachi
and Others

• **EDECO 200SS Drilling Rig**

AFFORESTATION

"Since it is certain and demonstrable that all arts and artisans whatsoever must fail and cease if there were no wood in a nation (for he that shall take his pen and begin to set down what art, mystery, or trade belonging any way to human life could be maintained and exercised without wood will quickly find that I speak no paradox). I say when this shall be well considered, it will appear that we had better be without gold than without timber."—Extract from Evelyn's "Sylva."

The above, though written over 280 years ago, applies more today.

Replant those felled areas NOW

Let us quote prices for

Forest Tree Seed, Seedling and Transplants, in the leading varieties, also ornamental Trees, Fruit Trees and Shrubs

Tree Catalogue on request Seed Catalogue issued in February
Correspondence invited

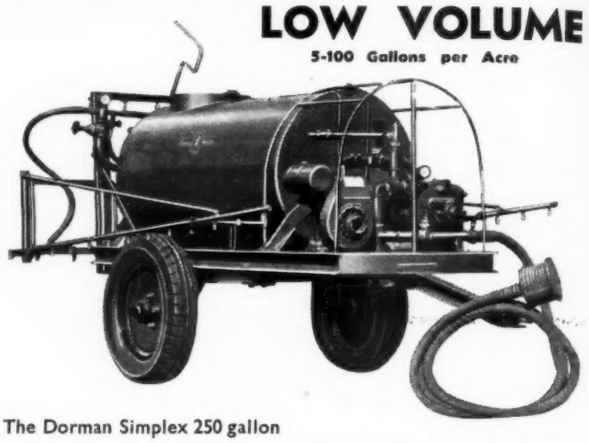
D. MELDRUM & SONS

THE FOREST TREE NURSERIES, FORFAR, SCOTLAND

TELEPHONE : 565 FORFAR TELEGRAMS : 565 FORFAR

HIGH VOLUME
LOW VOLUME

5-100 Gallons per Acre



The Dorman Simplex 250 gallon field sprayer, as illustrated, is just another example of our modern approach to the problem of crop spraying—this machine incorporates all the latest developments such as an automatic drum washer, row crop axle, quick change-over from high to low volume work, etc. When fitted with handlances and hose this machine has also been used successfully for fruit trees and bush spraying and is also suitable for cattle spraying.

DORMAN SIMPLEX SPRAYER CO. LTD.

408 CHERRY HINTON RD. CAMBRIDGE · ENGLAND

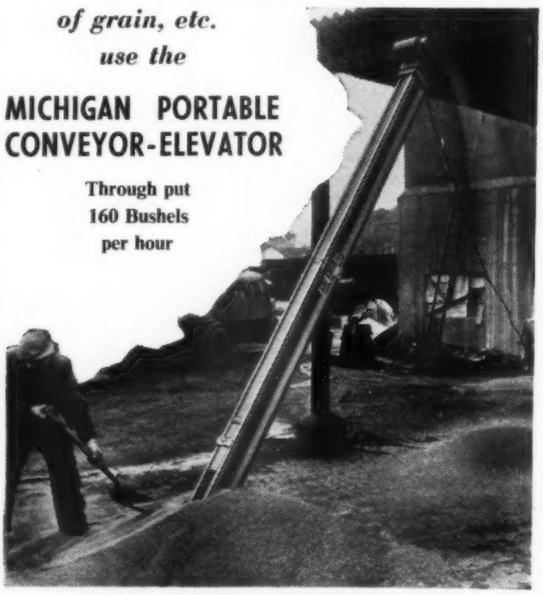
Telephone & Telegrams: CAMBRIDGE 87385

. . . *for efficient mechanical handling*

of grain, etc. use the

MICHIGAN PORTABLE CONVEYOR-ELEVATOR

Through put 160 Bushels per hour



★ *WE INVITE ENQUIRIES FOR OVERSEAS REPRESENTATION* ★

W. H. WALLACE & CO LTD

172 ST. JAMES'S ROAD · CROYDON · SURREY

For
SEEDS
CEREALS
FERTILISERS
FOODSTUFFS *and all*
powdered or fine produce

'PALFSACKS'

MULTI-PLY PAPER SACKS

The finest and most up-to-date container for bulk packaging. Clean and hygienic; free from seepage; dirt and dustproof; protective against vermin and other contamination; easy to fill, clean to handle

IN ONE TO SIX PLIES AND A WIDE RANGE OF SIZES OPEN MOUTHED OR VALVED

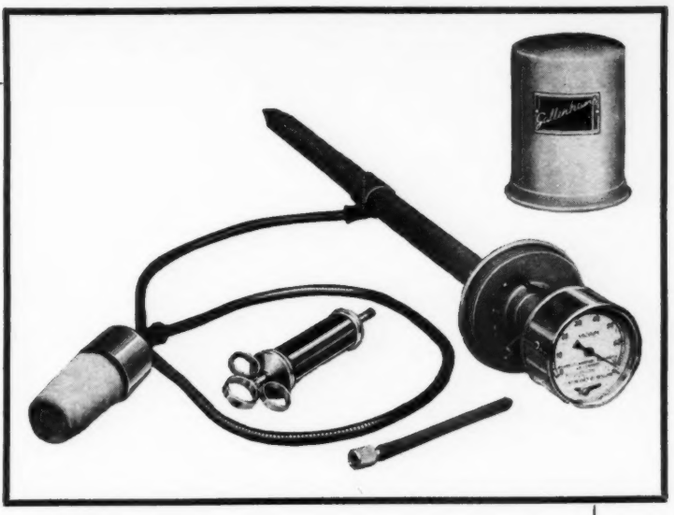
WILLIAM PALFREY LTD

Haddon House, 66a Fenchurch Street LONDON, E.C.3

Phone: Royal 7712 Grams: PALFSACK, Fen, London

ROGERS'

SOIL MOISTURE TENSIOMETER



This instrument is designed to give a continuous measurement of soil moisture at any desired depth below the surface. It consists essentially of a special type of porous pot which is buried in the soil at the required point and connected to a vacuum gauge or manometer. The action of the instrument depends on the soil moisture tension, due to the surface tension of the film of water surrounding the soil particles.

Records of soil moisture at different depths obtained by a series of these instruments are of great value, both in plant growth studies and in studies of water distribution in the soil. Where artificial watering or irrigation is applied, these instruments give a definite guide as to when it is necessary and also when sufficient has been applied. The instruments can also be used in pot cultures where standardised moisture conditions are required.

Full particulars sent on request

A. GALLENKAMP & CO. LTD

Manufacturers of Modern Laboratory Equipment and Scientific Apparatus

17-29 SUN STREET · LONDON · EC2

- **ENGLAND**
- **AUSTRALIA**
- **NEW ZEALAND**
- **SOUTH AMERICA**
- **HOLLAND**
- **DENMARK**
- **NORWAY**
- **SWEDEN**
- **WEST INDIES**
- **AFRICA**
- **EIRE**
- **FINLAND**

WORLD WIDE SUCCESS OF The 'Compton' Loader

Sole Agencies Still Available in Some Countries!

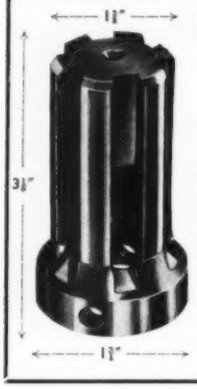
The Reason Why is here!

Visit Stand 131 Smithfield Show and see the Reason Why

FULL DETAILS ON APPLICATION TO EXPORT DEPT.

T. BAKER & SONS (FOUNDRY & ENGINEERS) LTD

COMPTON · BERKS · ENGLAND



P.T.O. SHAFT ADAPTOR KIT

This useful accessory quickly converts standard six spline 1⅜in. Tractor Power Take Off Shafts to 1⅜in. size, and new and old tractors will handle p.t.o. drive implements and machinery requiring either size coupling. The adaptor is of highest grade British manufacture (in one piece—no welding or brazing) in tough E.N.19 chrome molybdenum heat treated steel. It is splined inside to fit existing 1⅜in. shaft. The kit comprising adaptor as illustrated, with two grub screws and wrench, will be sent post free to World Crops subscribers for 42s.

LAWRENCE EDWARDS & COMPANY
Commercial Buildings
KIDDERMINSTER - ENGLAND
Trade enquiries invited

Cauliflowers Onions

Our Indian strains are grown from the Philippines to the West Indies and are recommended for any tropical or sub-tropical area where other varieties are unsuccessful.

SUTTON & SONS LIMITED
13D RUSSELL STREET, CALCUTTA, INDIA

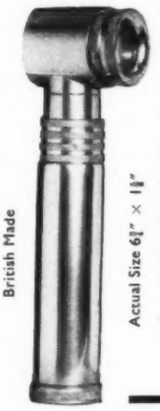
The PULMAC MILL

THE 'FINE' GRINDER

Finest Powder in one throughput

FOR ALL DRY MATERIALS FROM AGRICULTURAL LIMESTONE TO SUGAR

INTERNATIONAL PULVERISERS LTD
70 Victoria Street · London · SW1



The ULTRA LENS
is the Modern Electric Lens!

There are 1,001 uses for this precision made Electric Magnifying Lens. Laboratories, Research Stations, Universities, Growers and Industrial organisations find it invaluable for minute surface examinations of every conceivable object — fabrics, fibres, raw materials, botanical and biological specimens, seeds, grains, metals, tools, etc. It has been proved by the test of years to be all we claim.

Full particulars on request

THE ULTRA LENS COMPANY
49 Finsbury Court, Finsbury Pavement, London, E.C.2

INFESTED STORED FOOD PRODUCE

THE LONDON FUMIGATION CO LTD

Specialise in the control of
INSECT PESTS
in
STORED FOODS

LONDON	MANCHESTER
MARLOW HOUSE	ST. JAMES HOUSE
LLOYD'S AVE., EC3	BRAZENNOSE ST., 2
ROY 7077-8-9	BLACKFRIARS 7621

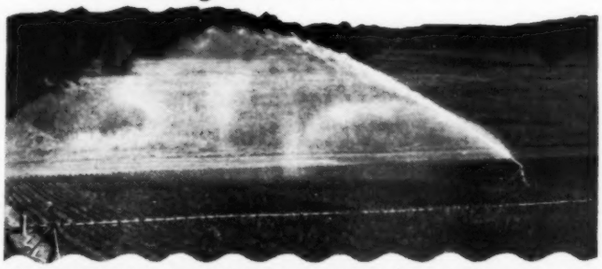
FOOD INDUSTRIES MANUAL

Cereals — Sugar Confectionery (Chocolates, Candy, Jams, Jellies)—Canning and Preserving Meat Products—Pickles and Sauces—The Dairy Industry — Food Dehydration — Edible Fats Fruit Juice Products—Storage and Refrigeration Handling—Packaging—Boiler House—Composition of Foods—Subject Index—Suppliers

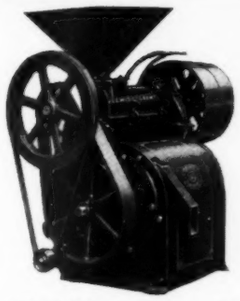
16th Edition now available—43s. post free

Published by
LEONARD HILL LIMITED
17 Stratford Place . London, W.1

make your own RAIN



SIGMUND IRRIGATION gives earlier crops at higher market prices!
SIGMUND PUMPS LTD., TERMINAL HOUSE, 52 GROSVENOR GARDENS, LONDON, S.W.1



RICE MILLS

Every Description of Machines for Treating Rice

Actual Makers

LEWIS C. GRANT

DUNNIKIER FOUNDRY · DYSART · SCOTLAND

NEW

4 MODELS

STANDARD HAND DRAUGHT

TRACTOR POWER TAKE OFF

TRACTOR SELF-POWERED

GARDEN TRACTOR MODEL

'MISTIFIER' L.O.

ESTATE SPRAYER

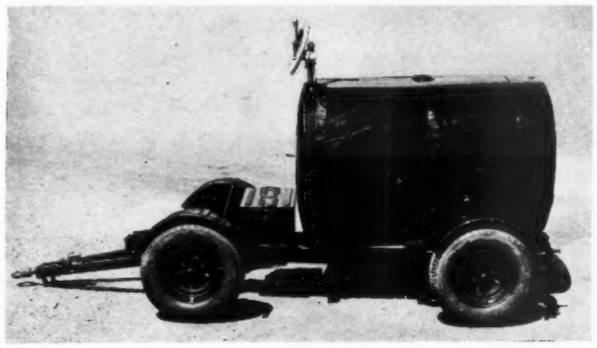
Giving the renowned 'Mistifier' efficiency, this trailer is light, low and narrow. Double acting, horizontal high-pressure pump is powered by 2½ h.p. engine, working pressure 300 lb. per s.i. at 260 gal. per hr. capacity. Tank capacities 35 or 60 gal. Please write for full details.

DRAKE & FLETCHER LTD

MAKERS OF BRITISH SPRAYERS

MAIDSTONE · KENT · ENGLAND

Farm Tractor Service Trailers



(EX W.D.)

Fitted with 500 gallon new galvanised steel tank, Semi Rotary pump, and 10ft. of reinforced hose

Two steel boxes for spares, petrol, etc., 2ft. x 1ft. 4in. and 1ft. x 6in.

FEATURES

Length 10ft., Width 5ft. 9in. Pneumatic tyres 700 x 16 (New)
Straight axles Steel roller bearings Spring loaded draw bar

Trailers built to Government Specification. New and guaranteed less than half cost. Finished in bituminous black

PRICE £75 carriage paid U.K.

Same specification 250 gallon £65 or trailer without Tank and Pump £40 carriage paid

S. T. BELTON (TRACTORS) LTD

TOWER ROAD · BOSTON · LINCS

TELEPHONE: BOSTON 2590 and 2690

facts at your fingertips—

766 text pages

•

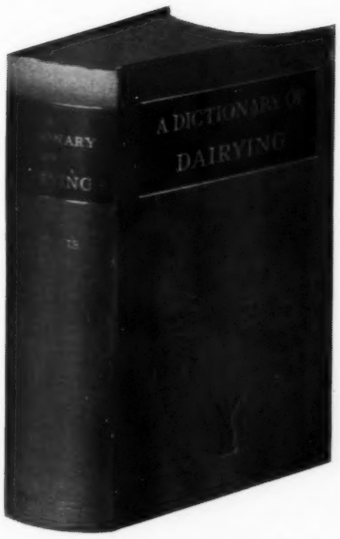
90 pages of catalogue section

•

Numerous photographs, drawings and tables

•

Price 38s. 6d. post free in Great Britain, 39s. post free abroad



Edited by Dr. J. G. Davis, Ph.D., D.Sc., F.R.I.C.

•

Contributed to by specialists in all the different aspects of dairying

•

Prospectus giving specimen pages available on request

Order yours now from the Book Sales Department

LEONARD HILL LIMITED, 17 Stratford Place, LONDON, W.1

CLASSIFIED ADVERTISEMENTS

SITUATIONS VACANT

A PROMINENT FIRM of Agricultural Seed Specialists is seeking the services of first-class representatives to cover various parts of England and Wales. Remuneration on the basis of salary, expenses and commission, with strong backing afforded to the successful applicants. Essential qualifications include a sound agricultural knowledge, previous selling experience and the necessary personality and initiative to establish and maintain friendly relations with farmers.—Applicants, who must possess a DEFINITE CONNECTION with farmers and who must also be owner-drivers, are invited to write, in confidence, to this advertisement, but replies will only be considered providing the fullest details are given in accordance with the above stipulations. Please state area in which interested.—Box 8028.

SITUATIONS REQUIRED

RESPONSIBLE work connected with the development of agriculture and the extension of food production is sought by London resident, age 40, who has extensive practical experience of farming, engineering and high-level administration. Willing travel anywhere. Box 5007.

MISCELLANEOUS SALES

DO you want a handysize baler to take out into the field for tripod work? The Opperman Light-Weight Motorised Portable Baler is deal for this purpose. Details from S. E. Opperman Ltd., Stirling Corner, Boreham Wood, Herts.

THE NEW MOTORCART is now obtainable with engine operating on tractor fuel. 8 h.p., 12 m.p.h., 30 cwt. load. Day-long carting for only 2s. 6d. Fullest particulars from S. E. Opperman Ltd., Stirling Corner, Boreham Wood, Herts.

CHEAPER THAN STRING, STRONGER THAN ROPE (breaking point 545 lb.). Ex-Army telephone wire, insulated, waterproof; suitable for fencing, packing, horticulture, tomato stringing, etc. Used by thousands of farmers in Denmark, Turkey, India, S. Africa, Spain, Mexico, Jamaica, Saudi Arabia, Rhodesia and England. 50s. delivered London Docks. Write for free sample.—Flowerdale Ltd., 16 Ogle Street, London, W.1.

SACKS AND BAGS FOR POTATOES, WHEAT, and any other purposes, for sale.—Write M. Grovic & Son Ltd., Sack Works, Adelaide Road, Reading, England.

ALTERNATORS, Diesel Sets, Electric Motors, Switchgear, Transmission Equipment, Fluorescent Lighting and Industrial Fittings, ex-stock. Keen prices.—Contact G. L. Murphy Ltd., Menston, Nr. Leeds.

WILD HARVEST THRESHER, new 1949, overhauled by makers, 1950, to include all latest improvements. Excellent order. Selling as getting larger combine.—Fitzgerald, Holmbush Farm, Newdigate, Surrey.

STOCKFEED POTATOES for sale.—For full details apply Horace Sullivan, Potato Merchant, 133 Widemarsh Street, Hereford.

ELECTRIC MAINS WELDERS, operate from 20 ampere meter, any voltage; £55 with condenser, etc. Demonstrations daily.—Production Promotion, 94 Camden Road, N.W.1.

OPPERMAN 'Quickgrip' Tractor Strakes. The only completely successful method of positive wheelgrip and ploughing efficiency under the worst soil conditions. Made to fit all the leading makes: Fordson Major, Nuffield, David Brown, Case, Ferguson, Farmall, Moline V, etc. Prices from £31 per set. Wheel sizes accordingly. —Fullest particulars from S. E. Opperman Ltd., Stirling Corner, Boreham Wood, Herts. ELStree 2021.

'RIDE A COCK HORSE TO BANBURY CROSS,' says the old nursery rhyme. But you'll get further by staying on the farm with the IRON HORSE, Britain's world-famous 6 h.p. £130 Light Tractor. It wasn't planned for riding jaunts, but those who prefer furrow-jockeying can also be supplied with a comfortable seat. And for £39 10s. you can slaughter weeds with the 1 h.p. British Anzani Motor Hoe (with adequate power for an inexpensive lawn-mower attachment); write for details now.—British Anzani Eng. Co., Ltd., Hampton Hill, Middx.

WHEELS AND HUBS FOR TRACTORS for all makes and types to take pneumatic tyres, immediate despatch from stock; no waiting. Heavy cast well-base for Fordson, David Brown, Allis-Chalmers, Case, John Deere, Massey-Harris, International, Oliver, M M., Ford-Ferguson, Ferguson-Brown, Marshall, etc., etc., also axles and wheels for lorries and farm trailers in all sizes, including 14 in., 15 in., 16 in., 18 in., 19 in., 32 x 6, 34 x 7, 36 x 8, 36 x 7, 40 x 8, 42 x 9, etc.—Goswell Rubber & Tyre Co., Ltd., 145-149 Camden Road, London, N.W.1. Tel. Gulliver 5421 and 5422. Wires: Goswelliro, Norwest, London.

MISCELLANEOUS SALES

MASSEY-HARRIS ALL-METAL HAY AND STRAW ELEVATOR with Wolseley engine fitted, has never been used, £150.—K. D. Lovell, Netheridge Farm, Hempsted, Gloucester.

OAK FIELD GATES bolted, creosoted, 8 ft., 8 ft. 6 in., 45s., 9 ft. 50s, delivered free nearest station, approval, cash with order.—Bickell, Westcott, Tavistock.

BRAND NEW 'Plymouth' No. XL3 Grinding Mill, 21 in. plates, for sale. First offer £50 secures.—Apply Lloyd Rakusen & Sons Ltd., Meanwood Road, Leeds 7.

WORLD CROPS

Small advertisements in this Journal must be prepaid, and will not appear unless payment is made by the 4th of the month preceding publication.

RATES

3d. A WORD

MINIMUM **4s.**

Box Numbers **1s.** Extra

Semi-Display Rates on Request

Replies to Box Numbers should be addressed to:

WORLD CROPS
17 STRATFORD PLACE, W.1

NO. 2 MIRACLE MILL complete with direct-coupled 35-h.p. Brook Motor. Reason selling installing No. 4 mill same make. Condition as new. Cost £490, accept £450 or near offer.—Box 5008.

AUTO-FEED RECORDER CLIP, £6 per 1,000, simplest ever for all batteries. Details or sample 100 at 12s. 6d. Auto-Feed (Canterbury) Ltd., Kent, makers of Britain's best Cafeteria Battery.

ASBESTOS SLATES, corrugated and flat sheets.—G. Paget Ellis, Ltd., 7 Oxford St., Leamington.

WE can supply good clean Casing Soil suitable for mushroom growing.—Walden Bros., Croft and Heene Nurseries, Bethesda, Mill Lane, Rustington, Sussex.

THE FIRST SUCCESSFUL light agricultural transport—the Opperman Motocart, 8 h.p., 12 m.p.h., 30 cwt. load, economical air-cooled engine, maintenance negligible. Specially packed for delivery to any part of the world. Fullest particulars, literature, prices, etc., from S. E. Opperman, Ltd., Stirling Corner, Boreham Wood, Herts, England.

RABBIT NETS, best quality hemp, 3½ft., 10/3; 4ft., 11/3 per doz.; corded, 1/3 extra. Long Nets, 50yds. x 3ft., fitted, 37/6 each. Snares, 17/6 gross, carr. paid, C.W.O.—Redport Net Co., Asker Works, East St., Bridport, Dorset.

FIRE HOSE. Heavy canvas, rubber lined, standard 2½ in. internal diameter (4 in. wide flat). Will stand very rough usage. 45/- per length, 48 ft. Hose clips, 18/9 per doz. Large stocks. Immediate dispatch.—Foundation Oil Co., Ltd., 8 Orford Hill, Norwich.

ALTRINCHAM JUTE LTD., sack and bag merchants and manufacturers of every description, 25 Viaduct Road, Broadheath, Altrincham, Ches. Tel. Altrincham 4360.

FERGUSON TRAILERS. We can supply hay ladders for this excellent trailer and double its usefulness. All fittings supplied. Trade enquiries invited. Price £9 per pair, c.w.o.—The Bridge Garage (Sedlescombe) Ltd., nr Battle, Sussex.

CLASSIFIED ADVERTISEMENTS

MISCELLANEOUS SALES

NISSEN-TYPE HUTS, ex-Government stock, reconditioned and supplied ready for erection. All sizes in 6ft. multiples. 36ft. x 16ft., £65 and £54; 24ft. x 16ft., £46 and £38; 72ft. x 16ft., £122 and £97; delivered U.K. Plasterboard Huts and other Buildings. Some 24ft. span Nissens.—Write, call or telephone Universal Supplies (Belvedere) Ltd., Dept. 42, Crabtree Manorway, Belvedere, Kent. Telephone No.: Erith 2948.

ROUND PEELED FIR STAKES, all lengths, 2 in./3 in. diameter tops, pointed for driving and creosoted under pressure. Also riven Oak Stakes, riven Ash Rails, etc.—Calders Ltd., London Road, Boston, Lincs.

ALL-WEATHER METAL CABS for Ferguson, Ford with Ferguson system, Ford 8 N.A.N. and Fordson Major tractors. Send for illustrated folder and prices. Weathershields Ltd., Bishop Street, Birmingham 5.

EX-W.D. TRUCKS. If you are interested in G.M.C., Dodge, Austin, Ford, Chevrolet. Any capacity up to 12 tons. Four-wheel drive, six-wheel drive or rear wheel drive only.—L. H. Sworder (Motors), Exporters of Trucks, Lane End, High Wycombe, Bucks.

ANALYSIS. Rapid Routine Analysis. Specialised Analysis. Ultimate Analysis. Assays. All Assays according to British Pharmacopoeia and Codex Bacteriological Examinations.—Write for particulars to Newchem Ltd., Poynton, Cheshire.

REEKIE FERGUSON Fruit/Agricultural Tractors.—Overall width 44 in.; track adjustable up to 56 in. in 4 in. steps; Ferguson hydraulically controlled implements. Equipment includes 100 gallon mounted sprayers; left and right hand ploughs, fruit guards; rotary cultivators; narrow fruit crop trailers.—Apply for full particulars from Reekie Engineering Co., Arbroath, Scotland.

TO CLEAR (owing to Town & Country Planning—we are removing to Great West Road): Tubular scaffolding, aluminium and steel for bull and cow pens, racking, fencing, etc., tarpaulins, extension and pole ladders, scaffolding boards, paint, asbestos sheets, flat and corrugated, bedsteads, angle-iron, fencing stakes, steel buildings, corrugated iron sheets, canteen tables and forms, chain link fencing, carpets, tablecloths, boiler suits, oilskins, overalls, trusses, huts, etc.—For further particulars write to Norda (Gt. Britain) Ltd., 162-166 Broadway, Southall, Middlesex. Tel.: Southall 3755 and 3227/8. 'Grams: 'Norda' Southall.

TITANINE AGRICULTURAL ENAMEL as supplied to leading tractor and implement manufacturers, is available in all standard shades for immediate delivery. —Write to Titanine Ltd., Colindale, London, N.W.9.

COMPRESSORS. Various types, sizes and pressures. ¼ to 10 h.p. belt, petrol or electric driven. Prices from £2 to £60.—Kirklands, 30 Lr. Byrom Street, off Liverpool Road, Manchester 3. Tel.: BLA 7144.

CHEAP GOVERNMENT WIRE!!! Great for training fruit trees, peas, beans, roses, arches, greenhouses, tomatoes, raspberries, tying, etc. Strong, flexible, steel-stranded and waterproof-covered. Postcard today for free samples. Several thicknesses. Greens Government Stores, 240 Albert Street, Lytham.

SPRAYING MACHINERY for all washes and dusts, limewash, creosote, etc. There is the right VERMOREL machine for every job. Prices from 18s. to £841. Catalogue from Cooper, Pegler & Co. Ltd., Chipstead, Surrey.

THE L.E.C. VAPORISER will make your Fordson Tractor last longer and will reduce your costs. 7,000 sold. Loddon Engineering Co., Ltd., Loddon, Norfolk. Phone, Loddon 214-316.

CORN STACK SHEETS, green proofed heavy jute tarpaulin, well finished, complete with long cords, 6 x 5 yds., 120/-, 7 x 6 yds., 168/-, 8 x 6 yds., 192/-, 9 x 7 yds., 252/-; medium weight green proofed cotton, 6 x 5 yds., 210/-, 7 x 6 yds., 294/-, 8 x 7 yds., 392/-; reconditioned, ex-Govt. black tarpaulins, 3/6 sq. yd. in all sizes from 9 x 6 ft. at 21/-, and larger up to approx. 18 x 15 ft. at 105/- each, all roped complete; send for list and samples; immediate delivery carr. paid.—Yeo Bros., Paull & Co., Ltd., Ashton Gate, Bristol, 3.

MISCELLANEOUS

MODERN self-drive cars and fully equipped caravans for hire. Write stating date of leave, make and h.p. required to Vacation Cars (Derby), opp. L.M. Region Railway Station, Derby.

DRAUGHTING CONTRACTS UNDERTAKEN. Agricultural machinery designed and developed. Press tools, jigs manufactured.—Technical Drawings Ltd., 7b London Road, Braintree, Essex.

ALL AMERICAN FARMING MAGAZINES available. Implement and Tractor, Farm Journal, etc.—Send for brochure giving full details from Willen Ltd. (Dept. 44), 101 Fleet Street, London, E.C.4.

WHEN on leave in Britain you will find travelling very much easier in a "New Look" car hired from Fairway Motors Ltd., Southampton. Drive Yourself. Unlimited petrol. Reasonable charges.